FOREST PLANNING STUDIO
ATLAS 6.0.2.0
TUTORIAL MANUAL

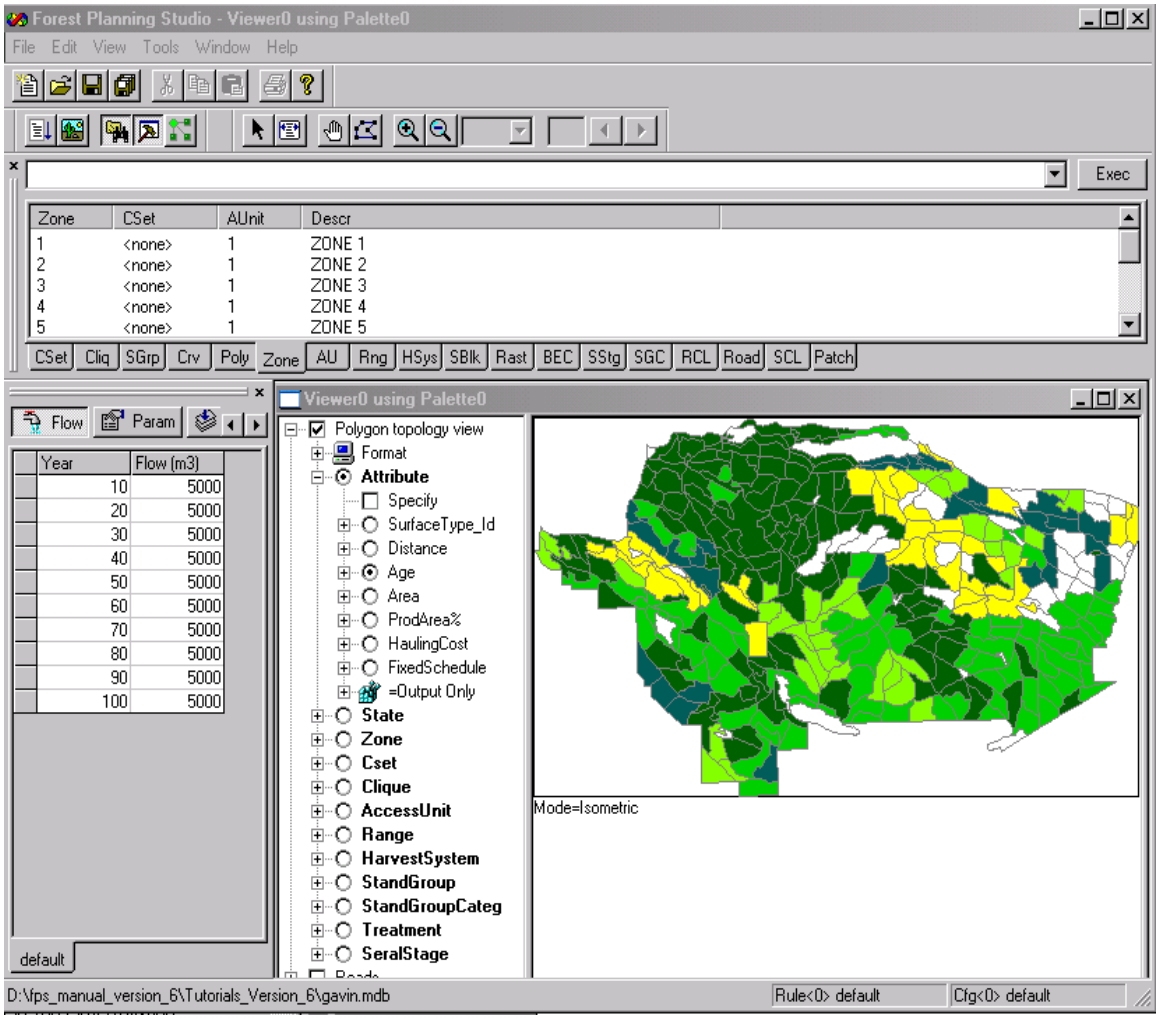

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TABLE OF CONTENTS

INTRODUCTION

This manual provides some basic examples of the FOREST PLANNING STUDIO (FPS) – ATLAS PROGRAM. These tutorials are nested and hierarchical so that the each tutorial prepares the user for the next. More specific and detailed explanations of FPS are available in the FPS-ATLAS manual. The manual and the FPS program are available at no cost on the FRST 424 web site or the ATLAS FTP site.

Downloading FPS-ATLAS from the FRST 424 Web Page (Recommended)

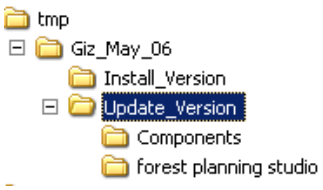
1.1. System Requirements

FPS requires the following software (check your versions) and system specifications.
Windows 2000, Windows XP
Microsoft Access 2000 or later

1.2. Connect to the FRST 424 web site at UBC http://courses.forestry.ubc.ca/frst424 Choose the Modelling tab and select ATLAS Model Documentation & Tutorials.

1.3. Under the heading FPS-ATLAS FILES, download "*FPS-ATLAS Install Program Files (Zipped)*" to a temporary folder (e.g D:\tmp). This downloads a file named *Giz_May_06.zip*. WARNING: DO NOT PLACE THE FILE WAY DOWN IN THE FOLDER STRUCTURE (e.g. C:\my stuff\junk\morejunk\junkagain\...\etc.

1.4. Unzip this file using the unzip to folder option and you will get the following structure:



1.5. Open the *Install_Version* folder and run Setup.exe to install FPS. It will install the program in the folder *Program Files\Forest Planning Studio, and a subfolder called Components.*

1.6. Now move to the *Update_Version* folder. Copy the files in the subfolders (*Components* and F*orest Planning Studio)* and overwrite the files in the corresponding folders found in *Program Files\Forest Planning Studio*, and the subfolder *Components.*

1.7. From the FRST 424 web site, download *FPS-ATLAS Tutorial Database (Gavin 2009)* to a working folder on your hard drive. This downloads the file *Gavin_2009.zip.* Unzip this file and you have *Gavin_2009.mdb*. You can now open this file with FPS.

Downloading FPS-ATLAS from the FTP Site

1.8. System Requirements

FPS requires the following software (check your versions) and system specifications.
Windows 2000, Windows XP
Microsoft Access 2000 or later

1.9. Connect to the UBC FTP Site using FTP software such as WS_FTP (this software can be found on the web at www.ipswitch.com).

atlas.forestry.ubc.ca
Login as atlas1
Password=atlas-1
Directory = Atlas\ATLAS-PROGRAM\FPS_Program\Version_6\

1.10. Copy the files in the *Install_Version* folder to temporary folder on your hard drive. WARNING: DO NOT PLACE THE FILE WAY DOWN IN THE FOLDER STRUCTURE (e.g. C:\my stuff\junk\morejunk\junkagain\...\etc. Within the *Install_Version* folder, run Setup.exe to install FPS. It will install the program in the folder *Program Files\Forest Planning Studio, and a subfolder called Components.*

1.11. From the FTP site, copy the files in the folder *Update_Version* to a temporary folder on your hard drive. Now copy these files to overwrite the files in the folders *Program Files\Forest Planning Studio,* and the subfolder *Components.*

1.12. From the FTP copy *Atlas\ATLAS-PROGRAM\FPS_Program\tutorials\Gavin_2009.zip* to a working folder on your hard drive. Unzip this file and you have *Gavin_2009.mdb*. You can now open this file with FPS.

Starting ATLAS-FPS on the UBC Forestry Lab Computers

You need to move a few files and set some defaults before running ATLAS-FPS on the computers in the forestry labs. The file *Gavin_2009.mdb* is a MSAccess database for the Gavin Block of the AFRF and is used in the training tutorials. The file *Palette.mdb* is an MS Access database file that controls viewing options (map colours and legends).

1. On your User drive, create a folder called “atlas”, and under “atlas” create another folder called “runs” (e.g. U:\atlas\runs)

2. Copy the file “*Gavin_2008.zip*” from the FRST 424 web page (Modelling\Atlas Model Documentation & Tutorials) to U:\atlas (the file is zipped, so unzip it when downloaded = *Gavin_2009.mdb*)

3. Copy the file *Palette.mdb* from the FRST 424 web page (Modelling\Atlas Model Documentation & Tutorials) to U:\atlas (the file is zipped, so unzip it when downloaded)

4. Start FPS (it’s under the Forestry Applications menu as Forest Planning Studio). Under tools, choose palette location. Select the file *Palette.mdb* in U:\atlas. Close the program and then re-start it. FPS will now use this palette file each time it is opened (you will have do this the first time you run it on a different computer in the labs).

5. You will also need to set a default directory in the run window (U:\atlas\runs) so that you don't fill your U: drive with megabytes of output files. You will be given instructions on this in the tutorials that follow.

The file containing the tutorials is on the FRST 424 web page modelling\Atlas Model Documentation & Tutorials\Documents*FPS-ATLAS Tutorials 2009*. There are 12 tutorials that you can progress through at your own pace.

There is also a program manual (*ATLAS User Manual*) in the same place that has detailed program information and formulation examples. I have printed 1-2 copies that I will leave in the class room.

Finally, the web site www.forestry.ubc.ca\atlas-simfor has quite a few extension reports on the model and its application to various planning problems.

Tutorial 1. Open a Database for Work with FPS

1. Create a Working File

FPS automatically saves changes to the *mdb* file as you work. The advantage of this design is that current edits are never lost, the disadvantage is that the original file is not retained. **It is therefore prudent to create a working file from the original file.**

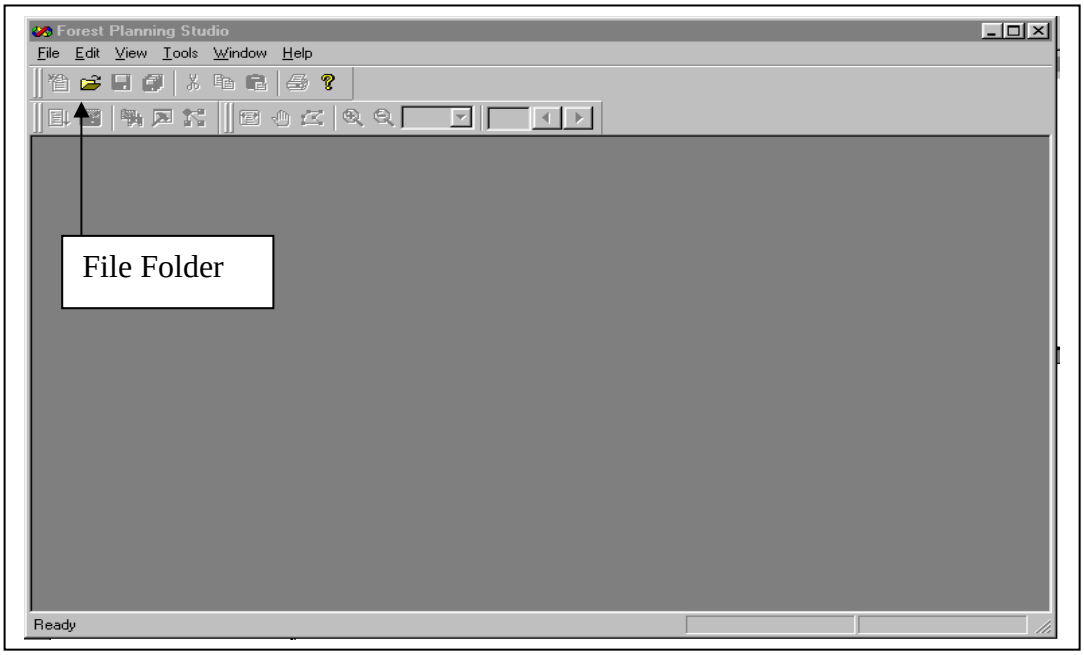
1.1. In *Windows Explorer* create a folder named *ATLAS* to save your FPS work (FSC students should create this folder on their U drive as described in the Introduction). Save the file ***Gavin_2009.mdb*** as a backup. To create a working file, make a copy of ***Gavin_2009.mdb*** and rename it ***GavinTut.mdb***.

1.2. To backup your work at the end of each tutorial, zip working file (e.g. **GavinTut.zip**). You can continue working on ***GavinTut.mdb***, but if for some reason you need a backup, just unzip **GavinTut.zip**.

Open Forest Planning Studio

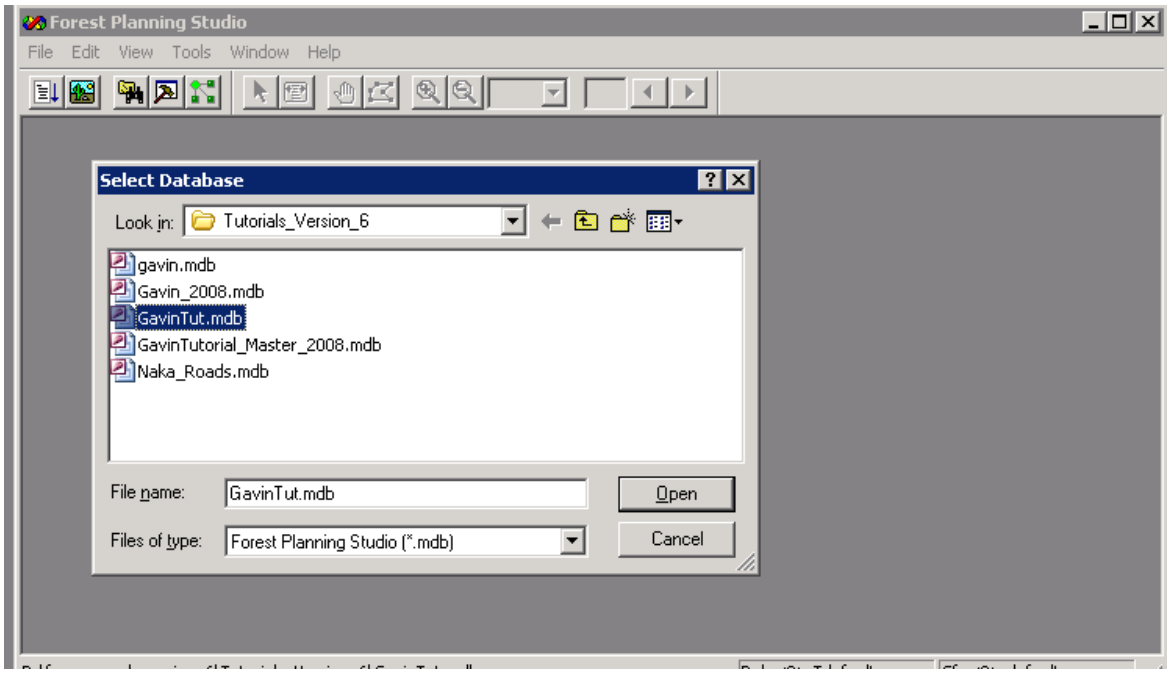
2.1. You will likely need to create a shortcut on your desktop to *FPS.exe* that is located in *C:\Program Files\Forest Planning Studio*. Once the shortcut is established, double click on the shortcut to open the FPS program.

2.2. The FPS window should appear as shown below.

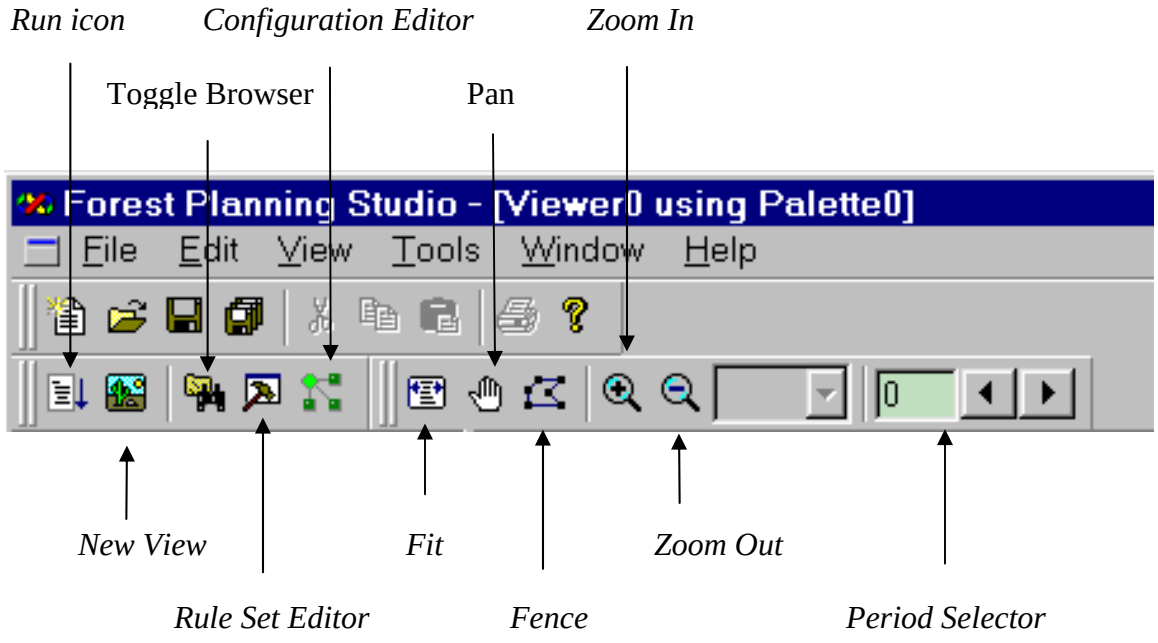


Load an Existing FPS Database

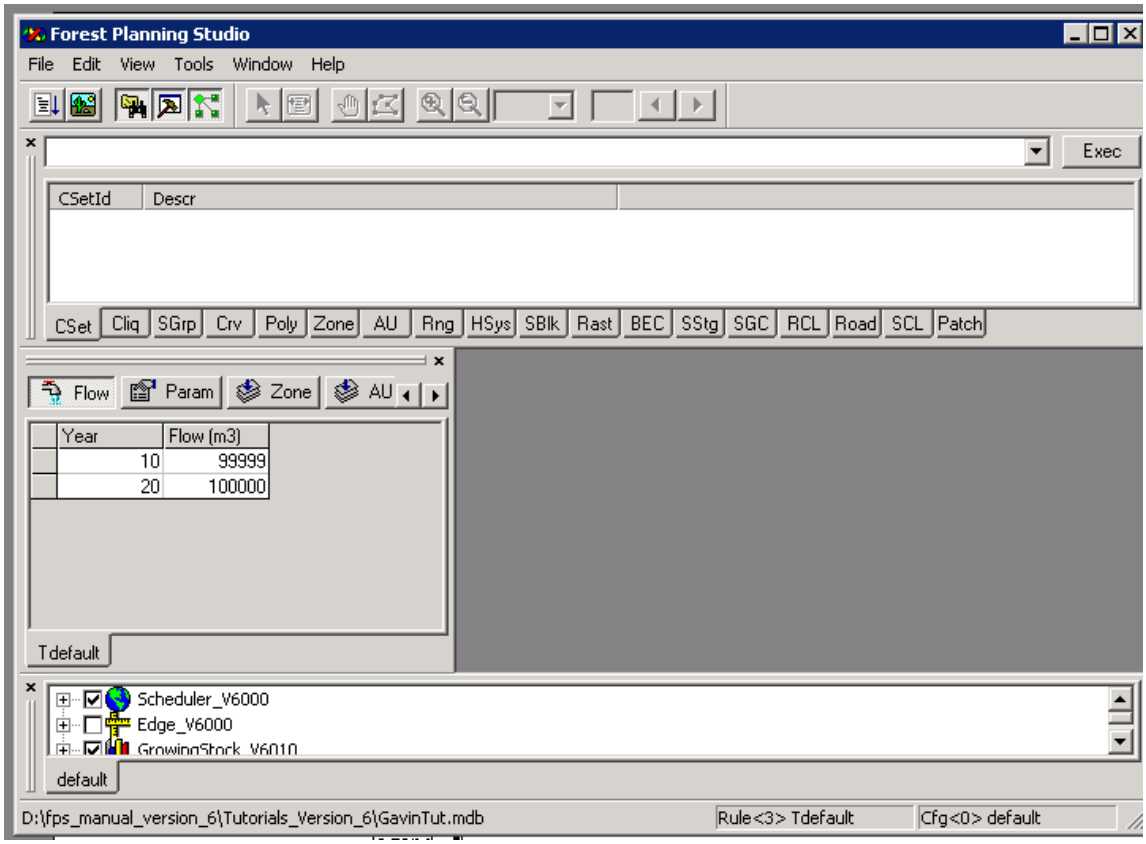
3.1. Click on the File menu and select Open. Browse for the file *GavinTut.mdb* and open it. You will not have all the files shown below, but you will have *GavinTut.mdb*.



3.2. Below is a description of the FPS toolbar icons. These toolbars are used regularly so it is helpful to become familiar with the icon names and functions.



3.3. Managing the Rule Set, Browser and Configuration windows. You will find three windows open. The default locations of these windows are: Browser and RuleSet on the right side and the Configuration at the bottom. You can move these windows to wherever you like. We suggest that you dock the RuleSet window on the left side, dock Browser at the top and leave the Configuration window docked at the bottom, as shown below. To dock these windows, just drag and drop to the appropriate location. **You should only have these windows open when you need them. Do not maximize these windows and use the FPS Toolbar icons to open and close them as needed. Maximizing the windows will tend to cover up other windows that you have neglected to close, resulting in a mess.**

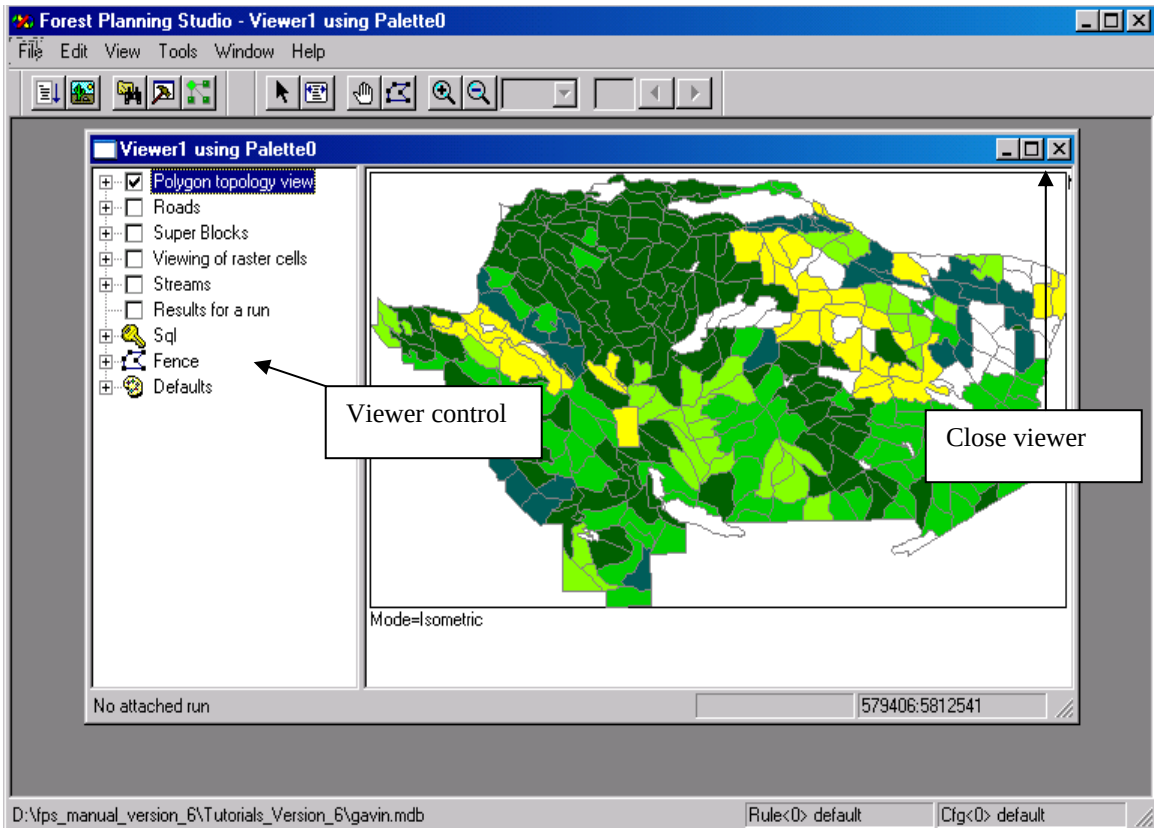


3.4. Close the Browser, RuleSet and Configuration windows using the FPS Toolbar icons.

3.5. To view the map of this database, click on the *New Viewer* icon. **Do not maximize the Viewer window. Maximizing the window will tend to cover up other windows that you have neglected to close, resulting in a mess that will come back to bite you. Always close the Viewer window when it is not needed.** The information presented in the *Viewer* depends on the *Viewer* settings from the previous FPS session. The current settings are indicated by checkmarks in the Viewer Control that is located on the left of the viewer window.

In the *Viewer Control*, click on the box adjacent to the *Polygon topology view*. Expand the *Polygon topology view* by clicking the + to the left of the checkmark. Continue to select, by clicking in the radio buttons, and expand to the *Attribute* and *Age* categories. The *Map Viewer* should display the age-class of each polygon and the Palette file is used to display the age-class legend.

Explore some other views available in the *Viewer*. Note that this particular database does not have roads, superblocks, raster cells or streams defined. Close the *Viewer* by clicking the **X** at the top right corner of the *Viewer*.

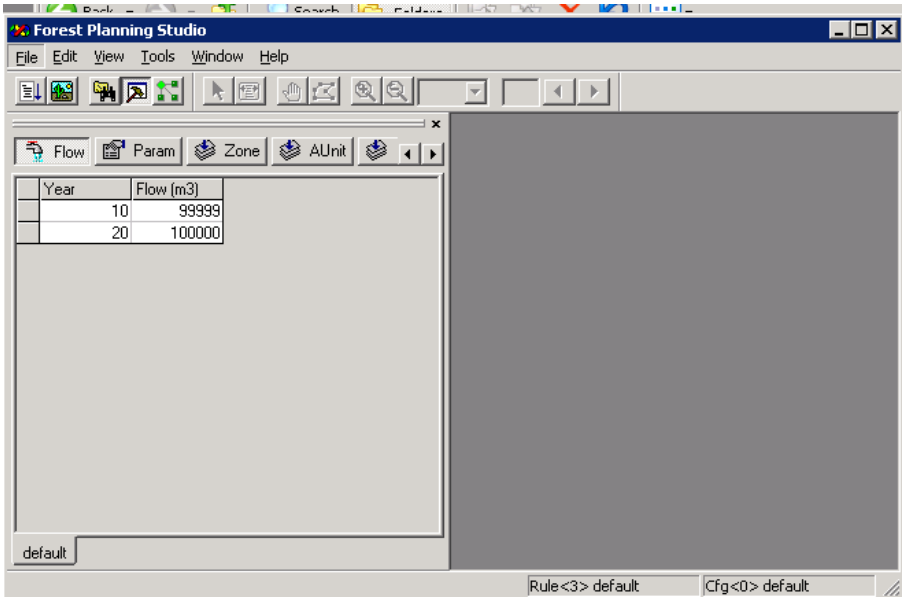

Forest Planning Studio - Viewer1 using Palette0
File Edit View Tools Window Help
Viewer1 using Palette0
Polygon topology view
Roads
Super Blocks
Viewing of raster cells
Streams
Results for a run
Sql
Fence
Defaults
Viewer control
Close viewer
Mode=Isometric
No attached run
579406:5812541
D:\fps_manual_version_6\Tutorials_Version_6\gavin.mdb
Rule<0> default
Cfg<0> default

Tutorial 2. Harvest Simulation

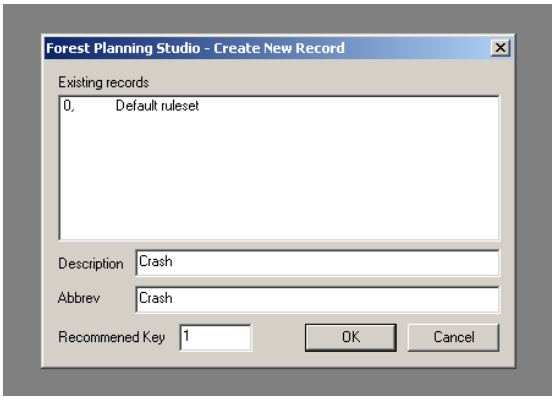
FPS simulates spatially explicit harvest scenarios based on target harvest levels & harvest priorities (found in the *Flow* & *Parameters* tab in the RuleSet window) and user-defined harvest constraints (*CSet*s found in the Browser window). This tutorial describes the first of these two basic procedures, i.e. *Flow & Parameters*.

2. Schedule Harvest Flow

1.1. Open the *Rule Set Editor*. The *Rule Set* window should appear as shown below. *Rule Sets* contain user-defined harvest flow targets and run parameters such as harvest priorities for age or distance and switches for Superblocks. It also provides an interface to set criteria for edge and interior forest calculations. Different *Rule Sets* can be created and saved. Each *Rule Set* is tabbed. In the figure below only the **default** *Rule Set* is shown.

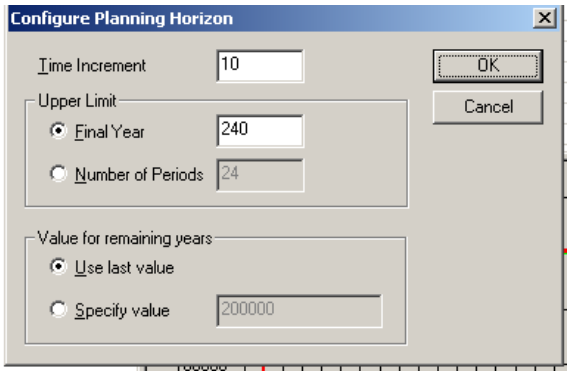


1.2. Create a new *Rule Set*. Right-click with the mouse inside the *Rule Set* window, select *New Rule Set* from the dropdown menu. The *Forest Planning Studio – Create New Record* window should appear as below. Enter the name **Crash** in the *Description* and *Abbrev* boxes. Select OK to save the new *Rule Set*

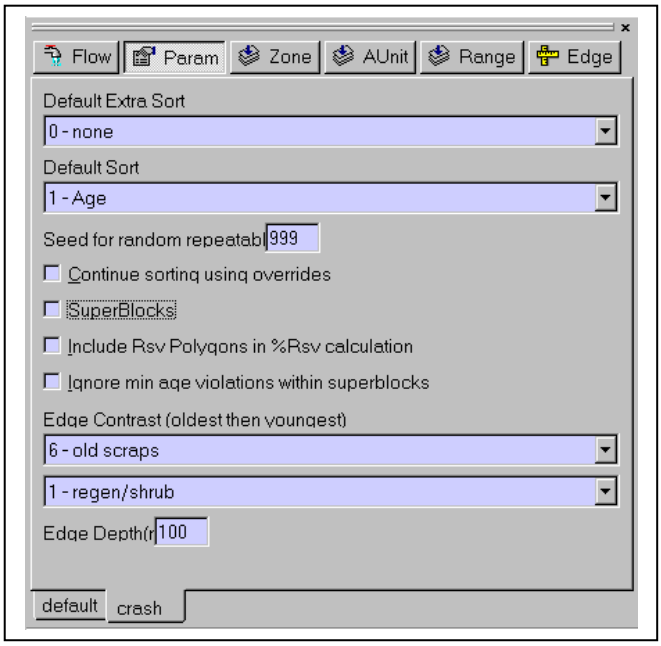


1.3. Ensure that the **Crash** tab is selected. Select the *Flow* tab from the *Rule Set* window. Highlight the *Year* or *Flow* box within the *Flow* window with the mouse. While the box is highlighted, depress the *Ctrl + Down-arrow* to create a row. Enter the *Year* **10** and a *Flow* of **200,000 m3**, **This value represents the total volume cut within that planning period (e.g. 10 years).** In FPS this periodic harvest volume is all cut in the specified year (10).

1.4. With the cursor in the *Rule Set* window click the right mouse button. Select the *Configure Flows…*, the Configure Planning Horizon window should appear (shown below). Enter a *Time Increment* of **10** (if not already displayed), a *Final Year* of **240** and *Use last value* to fill in the *Flow* of **200,000 m3**. The *Year* and *Flow* should now be filled in for the entire planning horizon.



1.5. Select the *Parameters (Param)* tab. Set the *Default Sort* to **1-Age** and the *Default Extra Sort* to **0-none** (always check the sort setting after creating a new *Rule Set*). The other boxes should be unmarked, the *Edge Contrast* as **6-old scraps**, **1-regen/shrub** and the *Edge Depth* to **100m**. These setting are shown below. Check that the remaining windows (i.e. Zone, AUnit, Range, Edge) are empty. The *AgeClass* tab will have some values in it and these should remain as they are.



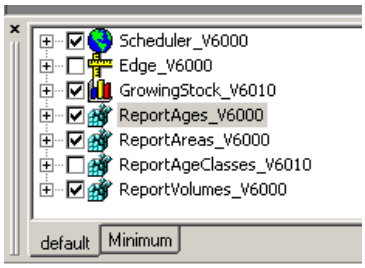
1.6. Close the *Rule Set* window by toggling it off with the FPS icon or clicking in the top right hand corner.

2. Module Configuration

The *Configuration* window contains the modules that will be run during each planning period. There are numerous modules that can be added, but they also affect FPS computing time, therefore include only those modules necessary.

2.1. Edit the configuration

2.1.1. Select the *Configuration Editor* icon. The *default Configuration* window should be similar to that shown below.

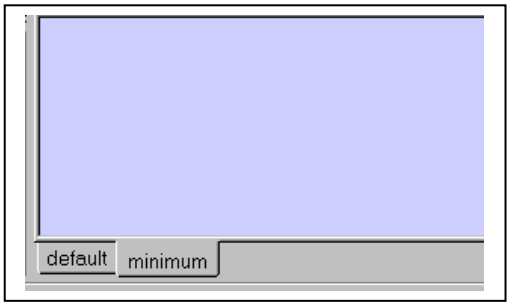


2.1.2. The checkmarks indicate modules that are active. To activate or deactivate a module, left click in the box to the left of the module name. These changes are automatically saved.

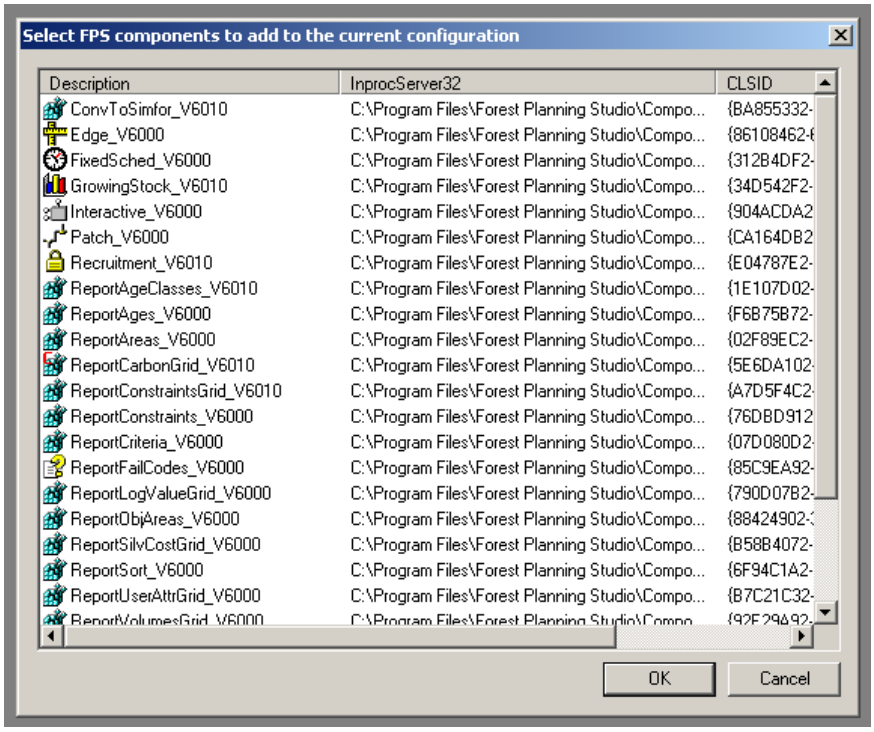
2.2. Create a new configuration

2.2.1. Locate the mouse pointer within the *Configuration* window, right click and select *New Configuration* from the drop-down menu.

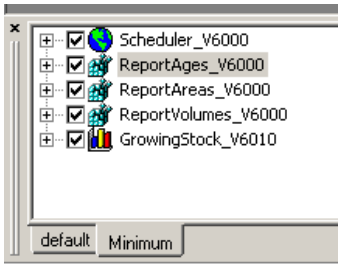
2.2.2. Enter **Minimum** in the *Description* and *Abbreviation* (*Abbrev)* windows. Select *OK*. The **Minimum** configuration should appear as a tab in the *Configuration* window.



2.2.3. Locate the mouse pointer within the **Minimum** configuration window and then right click. From the drop-down menu select *Append*. The *Select FPS Components to add to the current configuration* window should appear as below.



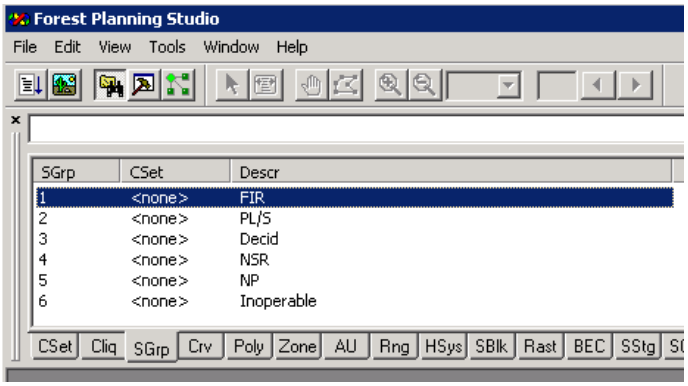
Highlight the *Scheduler_V6000* component with the left button of the mouse. Select *OK*. The *Scheduler_V6000* should now be displayed in the **Minimum** configuration window. Repeat step 2.2.4 to include *Report Ages, Report Areas, Report Volumes and GrowingStock*… The Configuration window should appear as below. You can now close the configuration window.
2.2.4.



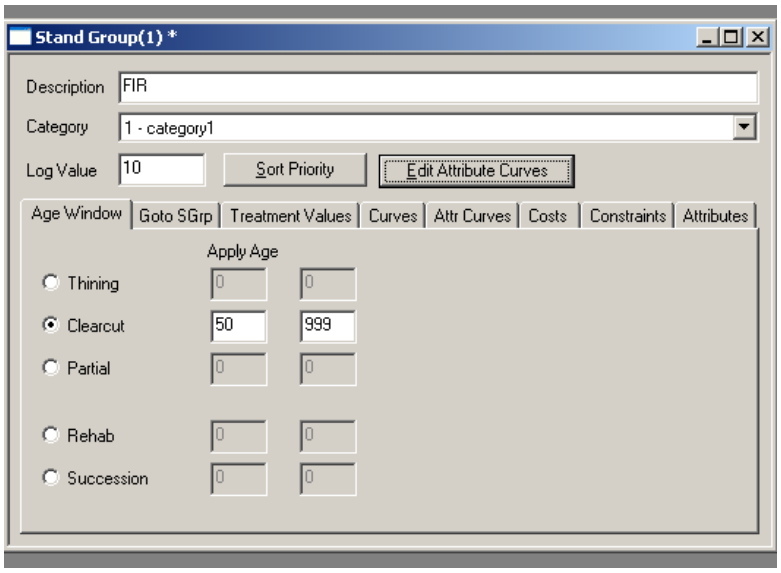
3. Apply a Treatment

3.3. Apply Clearcut treatments to *Stand Groups 1-FIR, 2-PL/S* and 3-*Decid*.

3.3.1. From the FPS toolbar select the *Toggle Browser* icon. The *Browser* window should appear as shown below. Open the (*Stand Group*) *SGrp* tab. Six Stand Groups are listed.



3.3.2. Select Stand Group 1 – FIR by double clicking with the left-mouse-button. The Stand Group 1 – FIR window should appear as below.



3.3.3. Click the Clearcut treatment radio button. Enter Minimum and Maximum values of 50 and 999 respectively. These are the minimum and maximum ages that define when the treatment is allowed.

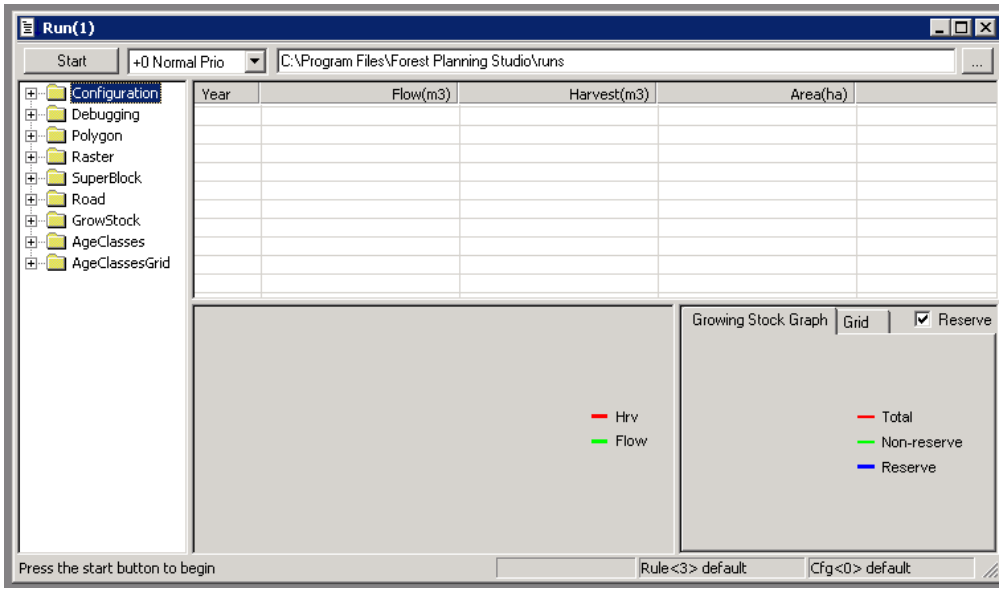
3.3.4. Close the Stand Group window by selecting the X in the top right corner. Accept the changes to Stand Group 1 – FIR. The Stand Group window will be used again in upcoming tutorials and reviewed in detail in Tutorial 7.

3.3.5. Repeat steps 3.1.2 through 3.1.5 for Stand Group 2 – PL/S and Stand Group 3 – Decid.

Close the Browser window.

4. Initiate a Run

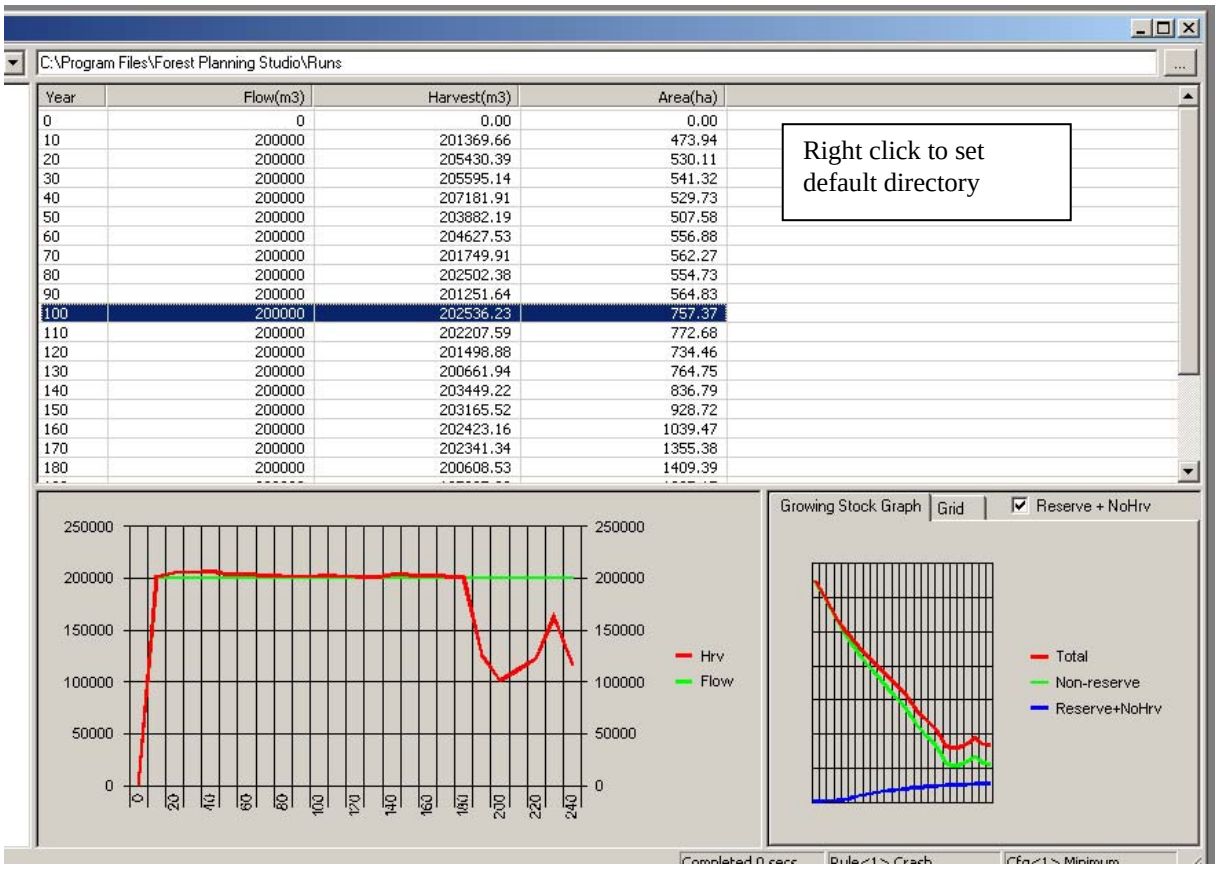
4.1. To initiate a run, click on the *Run* icon located on the FPS toolbar. The following window should appear.



4.2. Click the *Start* button. The simulation should have produced a harvest schedule of *Flow*, *Harvest* and *Area* values similar to those shown below. Notice that the *Flow* targets are achieved through the first 18 planning periods (*Year 180*) but decline rapidly beyond that period. These results have been automatically saved, in this example in *C:\program files\forest planning studio\runs (U:\ATLAS\runs* when running on the FSC computer labs). Unless a default folder for the run files is created, every run will produce a new folder that can become confusing and waste disk space. To avoid this do the following.

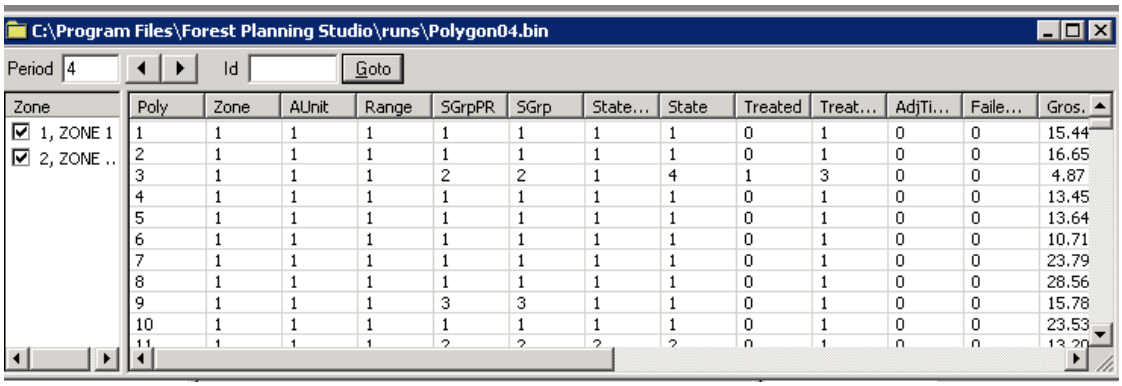
4.2.2. Change the name from *U:\January 18, 00@09-45-…* to *U:\Atlas\runs*

4.2.3. Right click anywhere in the run window and select *Save Directory as Default (*see Fig. below*)*. Now, all output files go to this folder, and will overwrite files from previous runs. This is OK because we can always replicate a previous run.



Note the Growing stock graph in the lower right corner of the Run window. Growing stock is measured as the total volume, regardless of age (i.e. not merchantable growing stock above the minimum harvest age). The blue line represents the growing stock in areas that are not eligible for harvest, and it steadily increases with time as these stands age in the absence of harvesting and natural disturbance. The green line is the growing stock that is not restricted from harvest and it rapidly declines until near the end of the planning horizon. This corresponds with the crash in the harvest schedule when there isn't sufficient timber to support the 200,000 m3/decade target. The red line is the total of the reserved and non-reserved growing stocks.

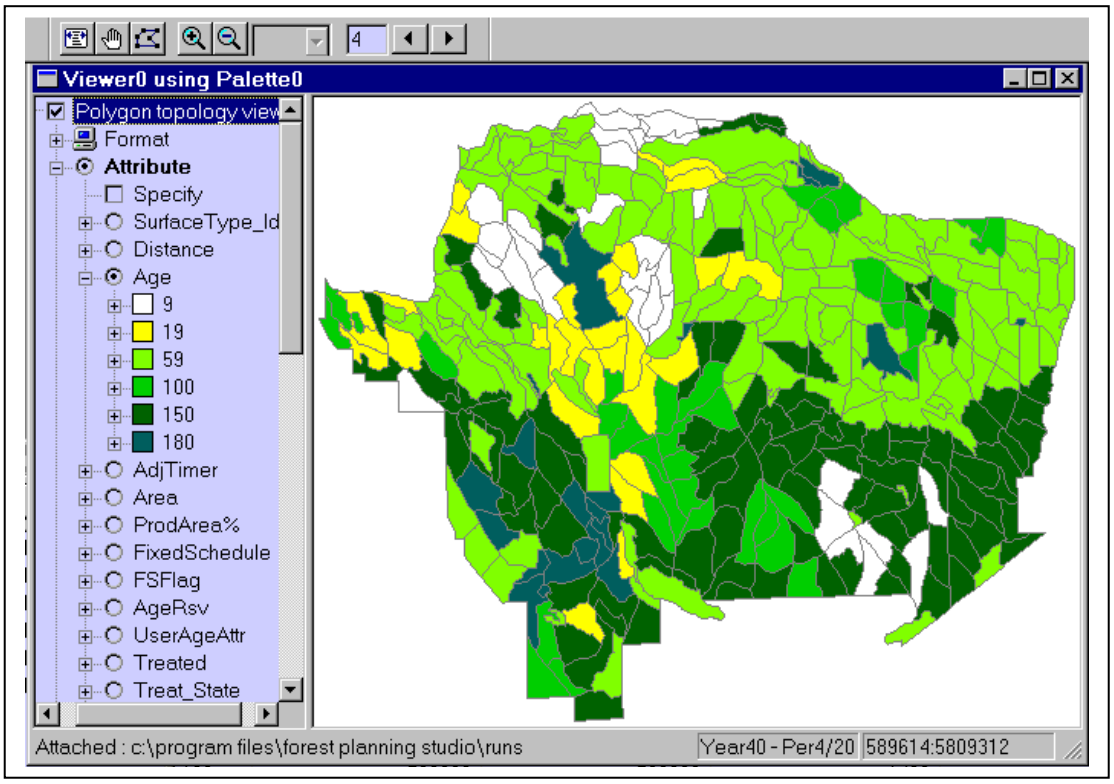
4.3. To view results in more detail, double click on a *Year* and from the drop-down menu select Polygon. For each *Period* of the simulation, you can view the attributes of each polygon. A portion of this detailed summary table is shown below. Use the *Period* selector arrows to cycle through the planning periods and observe how the attributes of each polygon change.



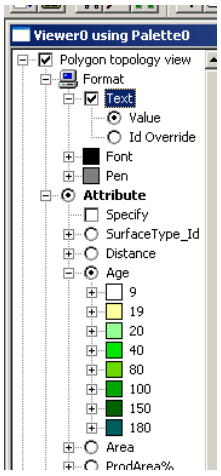
4.4. To view these results spatially with the *Map Viewer* highlight any *Year* shown in the *Run* window, drag and then drop this value into the *Map Viewer*. The *Period Selector* should become activated.

4.4.1. In the *Viewer* legend, left click on the box adjacent to the *Polygon topology view*. Expand the *Polygon topology view*, continue to select, by left clicking in the circles, and then expand the *Attribute* and *Age* categories. The *Map Viewer* should display the age-classes of each polygon while the *Viewer Palette* should display the age-class legend.

4.4.2. Use the *Period Selector* to cycle through the planning periods and observe the polygon ages.



You can have the viewer display the current age value of each polygon by expanding the *Format* tree at the top of the *Viewer Control* and selecting *Text* (See Fig. below).



5. Find the Maximum Harvest Volume

In the previous example the *Flow* targets were not achieved throughout the entire planning horizon. You will now modify the harvest flows so that the target is met in all periods. There are an infinite number of ways of doing this, so you need some guidelines. In our case, we want to maximize the early period harvest and gradually drop down to a long run sustained yield harvest. Further, the drop in harvest from one period to the next cannot exceed 10%, and the harvest is never to drop below the LRSY.

Create another *Rule Set* named **Conv + LRSY.** Note that FPS recognizes this as *Rule Set* **2**. **Note that the parameters set in the old *Rule Set* are not transferred into the new *Rule Set.* The desired parameters must be entered for each new *Rule Set*.**

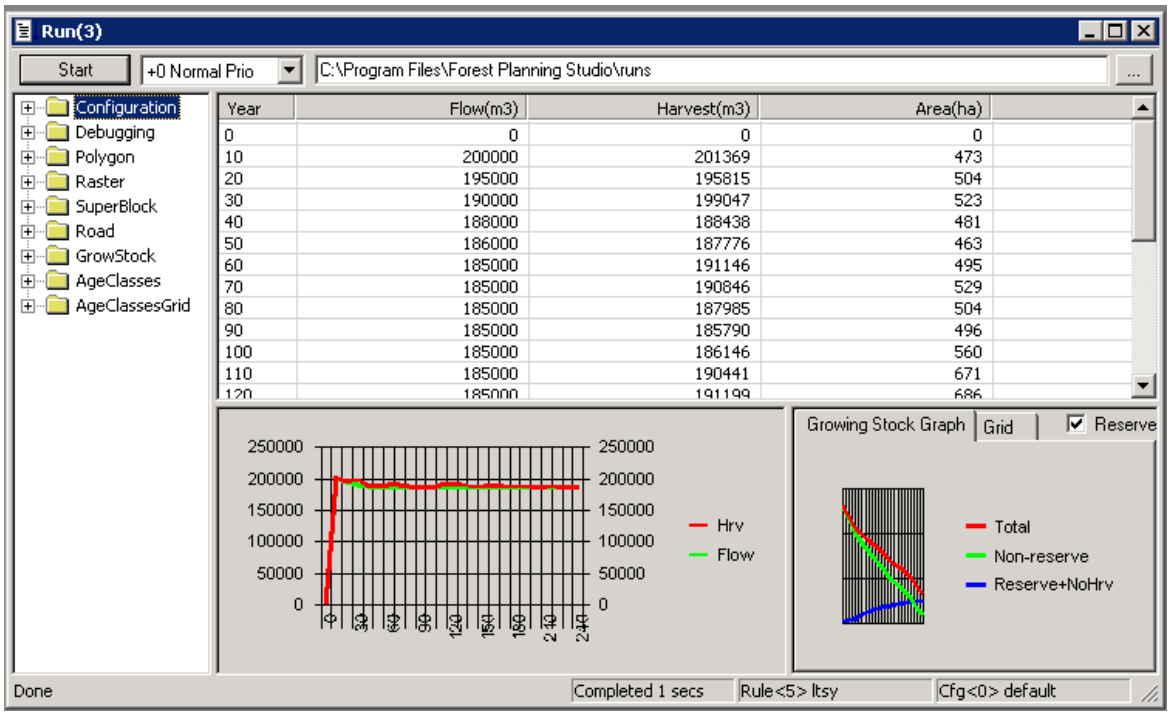
5.1. In **Conv+LRSY**, modify the harvest targets according to the table below. The harvest flows (targets) in this table were derived by trial and error and represent one possible solution to our scheduling problem.

5.2. Set the harvest priority (sort) to *Age*

NOTE –harvest targets to the nearest 1000m3 are quire sufficient for this tutorial. In general, we played with the first 3-5 periods until they worked, then we moved on to the latter periods. We then had to come back to the earlier periods for some final adjustments.

Year	Flow(m3)	Harvest(m3)	Area
10	200,000	201,370	474
20	195,000	195,815	505
30	190,000	199,048	523
40	188,000	188,438	482
50	186,000	187,776	463
60	185,000	191,146	495
70	185,000	190,846	529
80	185,000	187,986	504
90	185,000	185,790	496
100	185,000	186,147	561
110	185,000	190,441	671
120	185,000	191,200	686
130	185,000	191,506	641
140	185,000	186,805	644
150	185,000	188,667	672
160	185,000	189,600	726
170	185,000	188,482	753
180	185,000	186,657	826
190	185,000	189,527	958
200	185,000	185,553	899
210	185,000	188,004	927
220	185,000	187,193	1,043
230	185,000	185,709	1,204
240	185,000	185,868	1,624

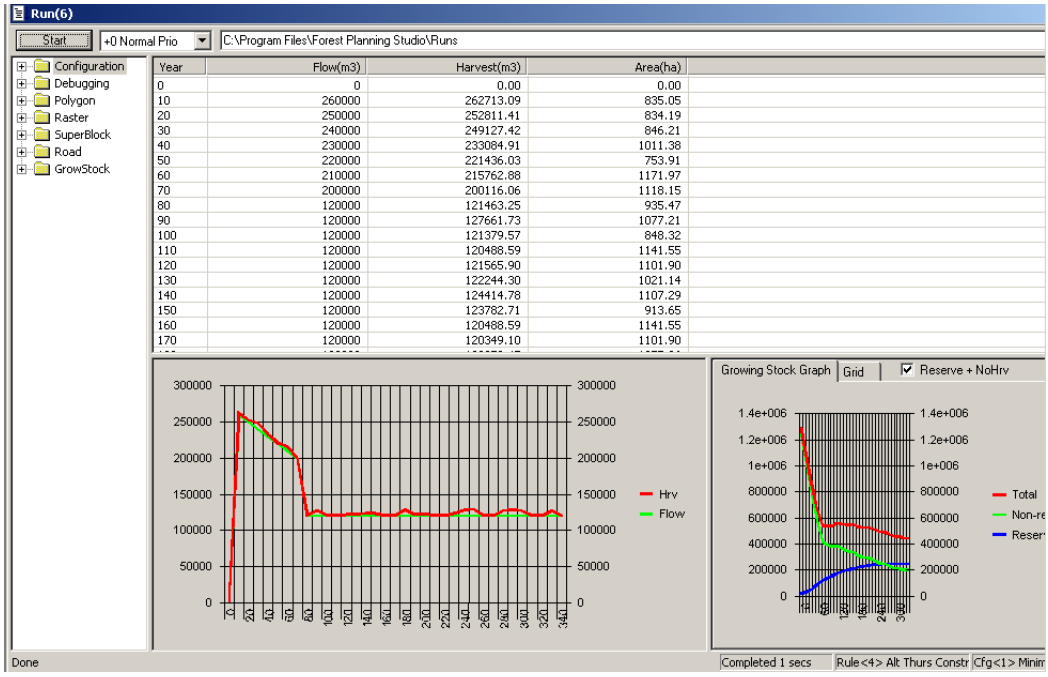
You should get the results shown in the following figure.



Note that the growing stock displays similar trends to the last harvest schedule, but it hasn't hit rock bottom (yet).

Question:
What happens if you run the simulation for another 100 years at 185,000 m3/decade (years 240-340 at 185,000 m3/decade?

An alternative harvest schedule following the same objectives (maximize early harvest, maximum 10% decline and harvest always >= LTSY) is shown in the following Figure. Note that the simulation was run for 340 years rather than 240 years, and that LTSY is lower over 340 years than it was for the 240 year run.



Note that the growing stock first declines rapidly and then declines at a slower rate. Ideally, we would like the harvest and the growing stock to stabilize in the long-term in order to have more confidence that LRSY has been reached.

Tutorial 2 Supplemental (Linking Estimates of LTSY and Extreme Departures to FPS Runs)

This supplemental section links some basic conversion concepts (e.g. LTSY, extreme departures) to harvest scheduling with FPS.

The Table below shows the area (ha) in the THLB and the N-THLB by age class as determined by an external query of the database.

AgeCls	THLB	N-THLB
0-20	938.7	434.1
21-40	83.7	61.3
41-60	462.7	0.0
61-80	1,235.7	0.0
81-100	317.4	0.0
101-120	1,670.4	3.5
121-140	503.0	32.8
141-160	30.4	1.6
161-180	85.6	16.3
181-200	46.7	0.0
201-220	125.1	0.0
240+	260.6	0.0
Total	5,760.1	549.6

Figure showing the initial age class distribution by the THLB and N-THLB.

A query of the database shows that Stand Groups 1,2,and 3 have 4005, 817 and 938 ha in the THLB, respectively. If these are to be harvested at age 50 years, the volume/ha cut is 118, 88 and 78 m3/ha, respectively. Therefore, our estimate of LTSY is 12,353 m3/yr or 123,530 m3/decade.

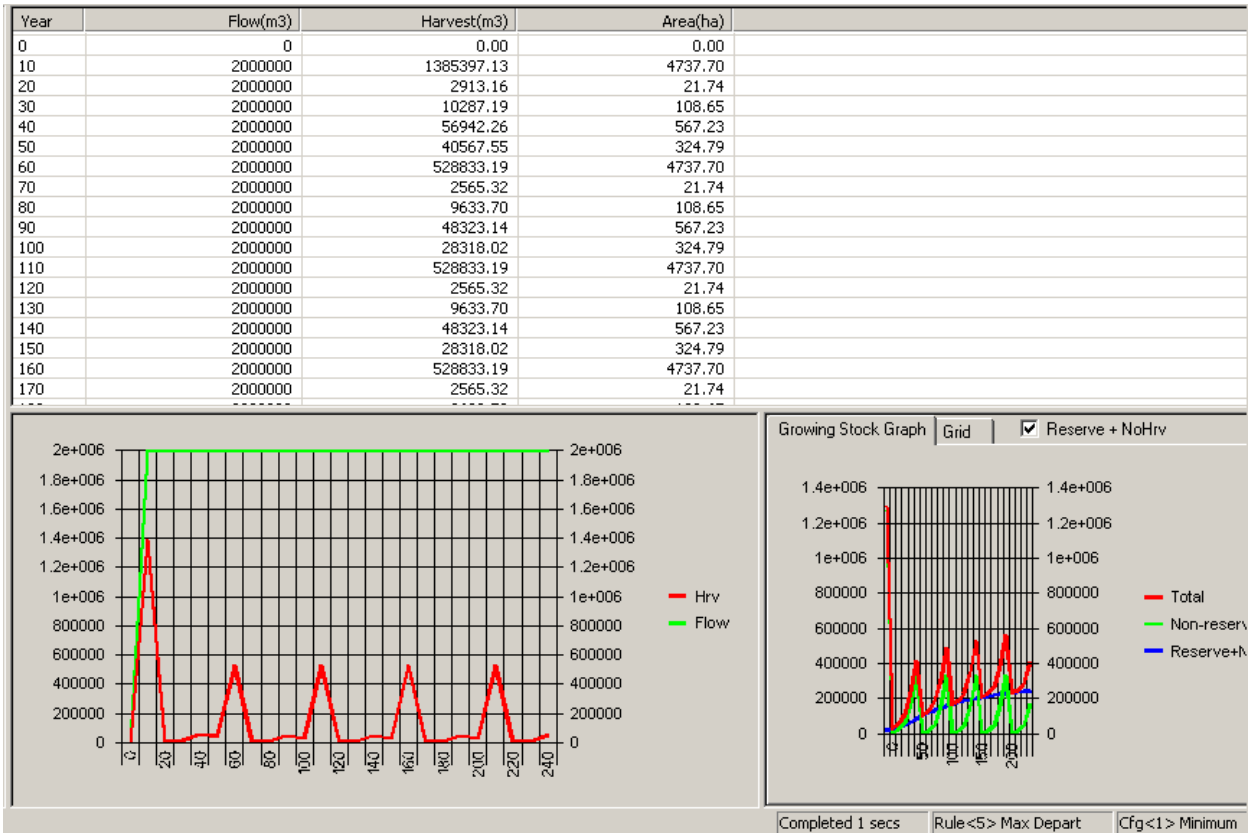
Estimate of LTSY

StandGroup_Id	SumOfArea (ha)	m3/ha@ age 50	LTSY m3/yr
1	4,005.3	118	9,453
2	817.2	88	1,438
3	937.6	78	1,463
Total	**5,760.1**		**12,353**

Note how close this estimate of LTSY is to that found in the alternate harvest schedule shown at the end of Tutorial 2 when the planning horizon was extended to 340 years.

Extreme Departure

Another good starting point is to see how the forest behaves at an extreme departure (harvest everything as soon as it is available). By setting the harvest target higher than that which can ever be cut (e.g. 2,000,000 m3/decade), we can see that a very high harvest is achieved every 50 years (next Figure). Create a new *RuleSet* called Max_Departure with these flows and *Age* as the harvest priority. Because of the initial age class distribution, there are still some stands that are harvested in between each 50 year peak.



Year	Flow(m3)	Harvest(m3)	Area(ha)
0	0	0.00	0.00
10	2000000	1385397.13	4737.70
20	2000000	2913.16	21.74
30	2000000	10287.19	108.65
40	2000000	56942.26	567.23
50	2000000	40567.55	324.79
60	2000000	528833.19	4737.70
70	2000000	2565.32	21.74
80	2000000	9633.70	108.65
90	2000000	48323.14	567.23
100	2000000	28318.02	324.79
110	2000000	528833.19	4737.70
120	2000000	2565.32	21.74
130	2000000	9633.70	108.65
140	2000000	48323.14	567.23
150	2000000	28318.02	324.79
160	2000000	528833.19	4737.70
170	2000000	2565.32	21.74

Figure showing the extreme departure. Note how the growing stock pattern is the "inverse" of the harvest. In periods of high harvest, the growing stock rapidly declines and in periods of low harvest, the growing stock increases rapidity.

At his point, you should have four *RuleSet* tabs as shown below. If you want to re-run a previous harvest schedule (*RuleSet*), just select the appropriate *RuleSet* and run the model. This is how FPS-ATLAS allows us to create multiple harvest scenarios within one database (e.g. GavinTut.mdb), and it is the reason we don't need to save our output files every time we run the model.

AT THIS POINT YOU SHOULD EXIT FPS AND ZIP YOUR DATABASE (GavinTut.zip). THIS WILL BE YOUR BACKUP IN CASE YOU MAKE SERIOUS ERRORS IN SUBSEQUENT TUTORIALS. ZIPPING THE DATABASE AT REGULAR INTERVALS IS YOUR BEST BACK-UP METHOD.

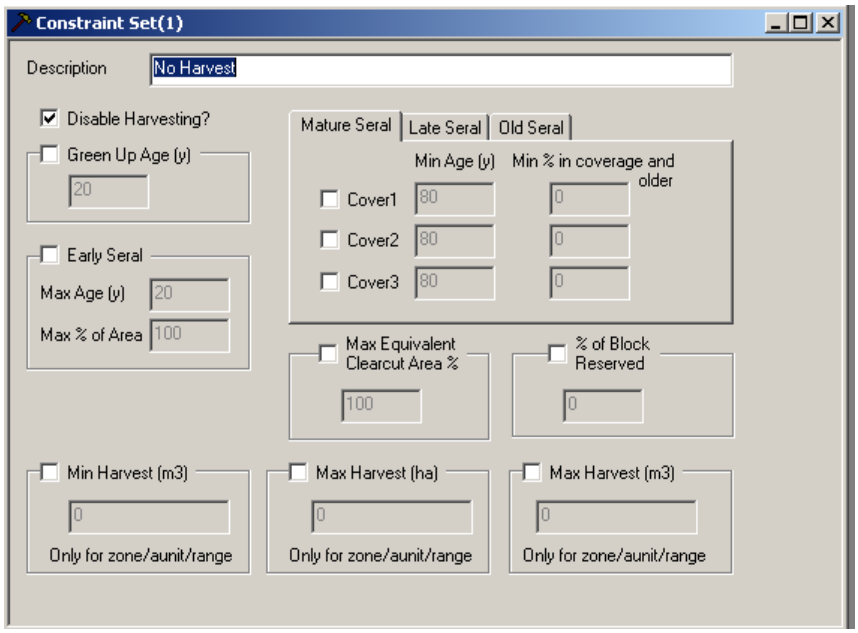
Tutorial 3. Constraints and Harvest Parameters

(Continue with the database GavinTut.mdb)
To model with FPS it is necessary to define the constraints (*CSets*) that will affect harvest scheduling. In Tutorial 2 harvesting was scheduled without constraints, however, in practice there are always numerous constraints. Often, constraints vary throughout a forest estate and therefore it is necessary to define and apply a number of different *Csets*. Further, one of the real values of forest-estate modeling is the opportunity to observe the consequences of various scenarios. Therefore, a variety of different CSets are created and applied to each area within the forest estate. This tutorial describes the basic procedures necessary to define these constraints.

6. Create a *Constraint Set* (*CSet*)

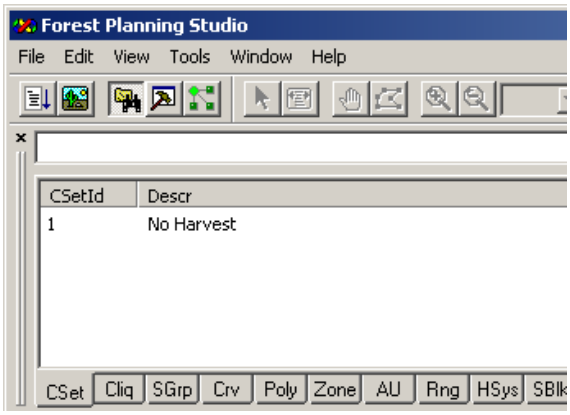
A *Constraint Se*t is a collection of management objectives that impose constraints on harvesting. FPS allows a number of constraints to be identified and applied as a single set; the *Constraint Set*.

1.1. Select *File*, then *New*, then highlight *Constraint Set*, and then *OK* to accept the selection. The *New Constraint Set* window should appear. Check the *Disable Harvesting?* box.. In the *Description* box type: **No Harvest**.



1.2. To save the **No Harvest** constraint set, close the *New Constraint Set* window and then accept the changes.

1.3. Select the *Toggle Browser* button, the *Browser* window should appear. Select the *CSet* tab at the bottom of the *Browser* window. You will see the **No Harvest** Cset listed (Fig below). Note: You may have to click the *Exec* icon or the press the *F5* key to refresh the window.



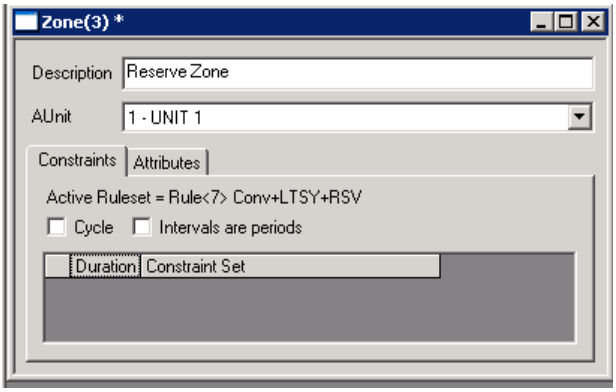
1.4. Now make a new *RuleSet* called **Conv+LTSY+RSV.** Copy the harvest flows from the *RuleSet* **CONV+LTSY** and paste them into the new *RuleSet* **CONV+LTSY+RSV**. Also set the harvest priority to Age in the new *RuleSet*. We are making a new RuleSet that will use the harvest flows from CONV+LTSY, but it will also be linked to the **No Harvest** *CSet. CSets* must be linked to a RuleSet to be active.

Close the RuleSet window.

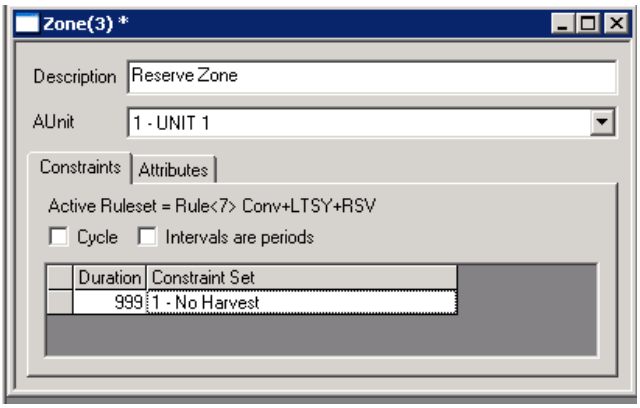
2. Apply the No Harvest CSet

2.1. Now that the **No Harvest** *CSet* has been defined it is necessary to apply it to a spatial unit (i.e. a *Clique*, a *Zone*, an *Access Unit*, or a *Range*.

2.2. This newly created *CSet* can be applied to an existing *Zone* or, alternatively, a new *Zone* can be created. To create a new *Zone*, select: *File*, *New*, *Zone*, *OK*. Type in *Reserve Zone* and the *New Zone* window should appear as in the Figure below. Note that two zones (Zone 1 is the THLB and Zone 2 is the N-THLB) already exist, so you new Zone is number 3. Close this window and accept the change.



2.3. In the Browser window, open the **Reserve Zone** window and select the *Constraints* tab. In the Constraints page highlight the *Constraints Set* box and then simultaneously press the *Ctrl* + *Down-arrow* keys. A drop-down list of *CSets*, including **No Harvest**, should appear. Double-click on **No Harvest** to apply this *CSet* to the **Reserve Zone**. As a default, this *CSet* will be applied for a *Duration* of 999 years (see Fig. below). Accept the changes.



Close the Browser widow.

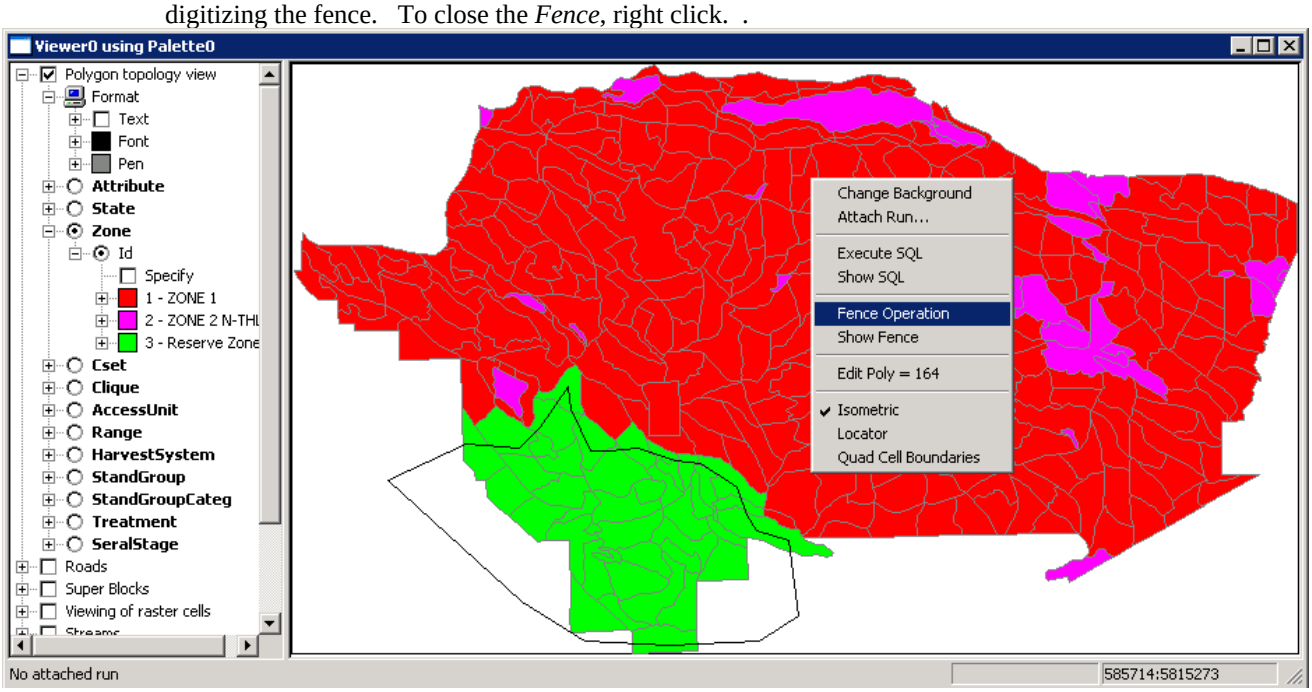
3. Define the Reserve Zone spatially

3.1. It is always necessary to physically define spatial units. Once the **Reserve Zone** has been created it is necessary to add the desired polygons to it.

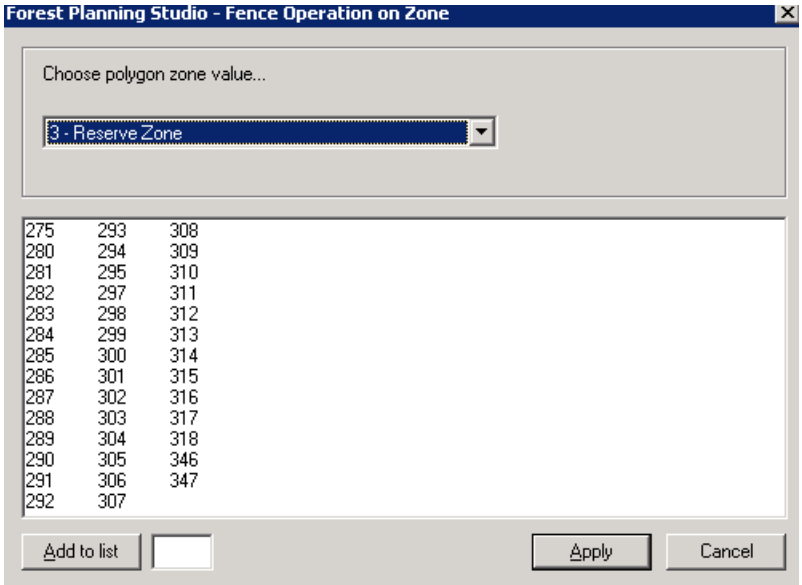
3.2. In the Viewer's legend, expand the Polygon topology view by pressing the + beside it, and then select Zone from this expanded list. Expand the Id to view the Zone legend. **Reserve Zone** should be included in this list. If not, select Refresh from the Window caption on the FPS toolbar. If the **Reserve Zone** is still not listed the Zone was not properly created.

3.3. *Polygons*, the basic spatial elements in FPS, can be assigned to *Zones* by fencing operations, polygon edits or executing SQL operations. This example will demonstrate the fencing operation.

3.3.1. On the FPS toolbar, press the *Fence* icon  . The mouse's pointer can now be used to "digitize" around polygons (i.e. fence) that you want to select in the *Viewer* map. As long as any portion of a polygon is contained within the Fence, it will be selected. Select the polygons located in the south-west portion of the Gavin Lake map (See Fig below) by left digitizing the fence. To close the *Fence*, right click. .

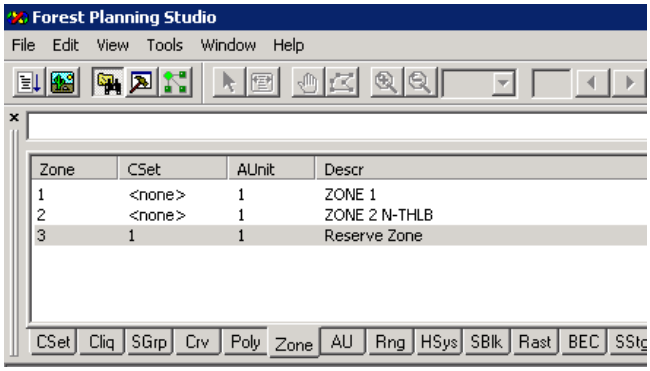


3.2.2. With the pointer located anywhere in the *Viewer*, right click and select *Fence Operation*. A dialog box listing the selected polygons should appear. This list can now be edited, polygons can be added by typing in the polygon number and selecting *Add*, polygons can also be deleted from this list by highlighting the polygon and then depressing the *Delete* key. Edit your list so that the only those polygons listed below are included on your list.



3.2.3. In the Fence Operation window, the *Choose polygon zone value*, and select **3 Reserve Zone**. Then click the Apply button and answer *yes*.

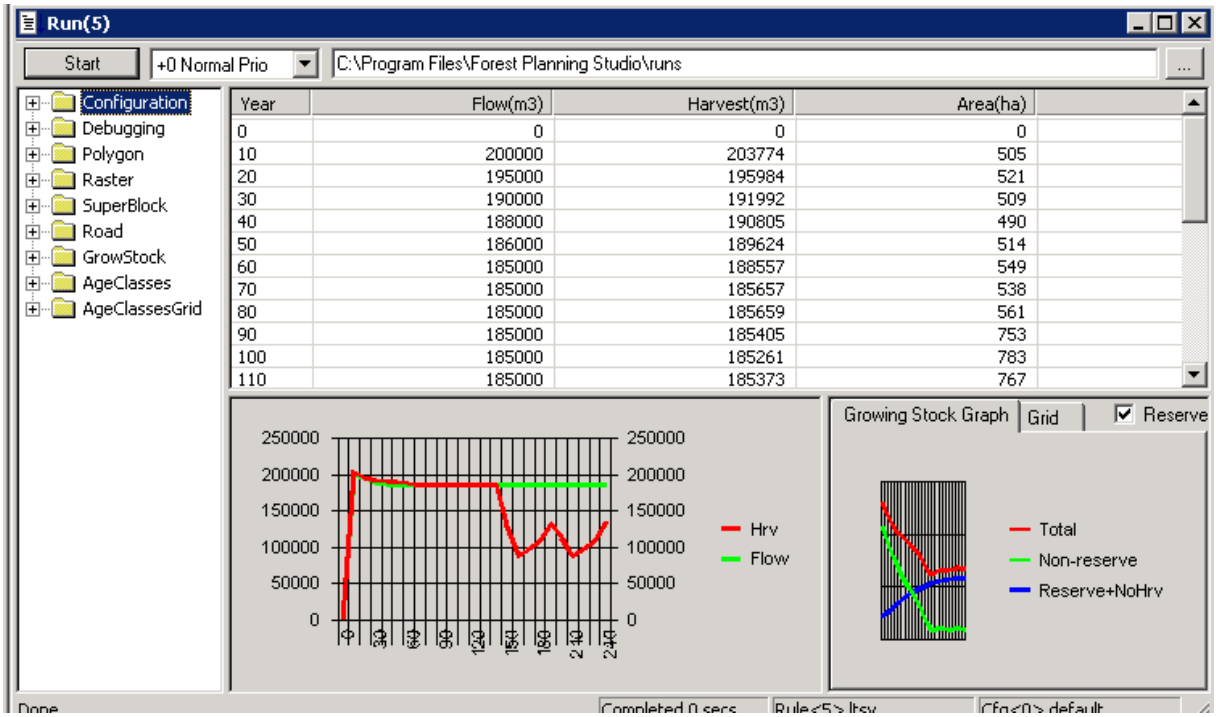
3.2.4. **Reserve Zone** and its **No Harvest** *CSet* are now applied spatially and are visible on the *Map Viewer*. In the *Viewer Control*, select *Zone* and you will see the new Reserve Zone. Select the *Browser* and click on the *Zone* tab, **Reserve Zone** should have *Constraint Set #1* (**No Harvest**) applied to *Zone*



Close the Browser.

4. Run the simulation

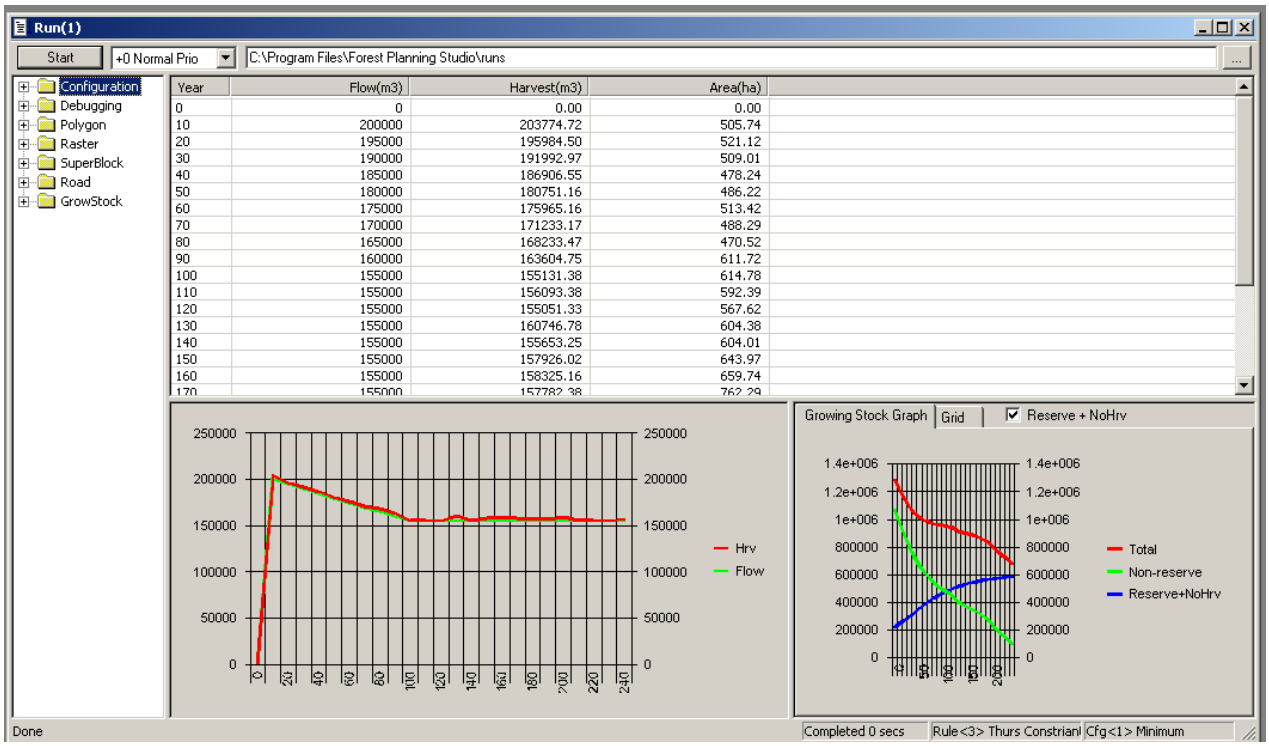
4.1. Make sure that you are still in the Conv+LTSY+RSV RuleSet. FPS will now include the No Harvest Constraint for the Reserve Zone. Click the Run button and you should get the following harvest schedule.



Open the Viewer and ensure that the polygons in the Reserve Zone are never harvested (they all grow older).

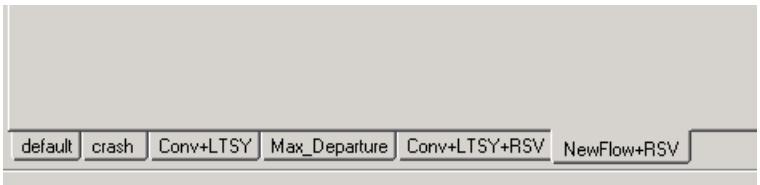
4.2. Now create a new *RuleSet* called **NewFlow+RSV**. Be sure to set *Age* as the harvest priority and apply the **No Harvest** *CSet* to the **Reserve Zone** (recall that *Csets* are not automatically transferred to new *RuleSets* – they must be manually linked each time a new *RuleSet* is created). Then add the flow targets shown in the Figure below (the easiest way to do this is to copy the flows from the **Conv_LTSY+RSV** *RuleSet* and paste them into the new RuleSet). The new harvest flows have been adjusted downwards to reflect the loss of the THLB caused by the reserve zone. This was done through trial and error (i.e. iteration) until the harvest flow objectives were met (transition to new LTSY).

Close the RuleSet window.



Note the growing stock …what happens if you run the simulation for 340 years?

At this point you should have the following *RuleSets* (i.e. management scenarios) in your model.



Edit the Colour Palette

To edit the colour palette of the **Reserve Zone** (or any other Zone or legend) click on the colour box next to the component that you would like to change. A colour box will pop up on your screen and you can choose

the colour you want from here, select *OK* to apply the changes. Alternatively, right-click on the component title, select *Edit* and then select the colour and apply as above.

We hope you are wondering what is going on with Zone 2 (N-THLB) and why we don't have a **No Harvest** *Cset* applied to it. The answer is that the polygons within this zone are permanently reserved using the *State* field (RSV) in the polygon window. There are a number of ways to reserve polygons from harvest, and this is one of them. You can observe the state field in the *Viewer Control* by clicking on the State button.

BE SURE TO EXIT FPS AND ZIP THE DATABASE AS A BACKUP

Tutorial 4. Apply an Adjacency Constraint

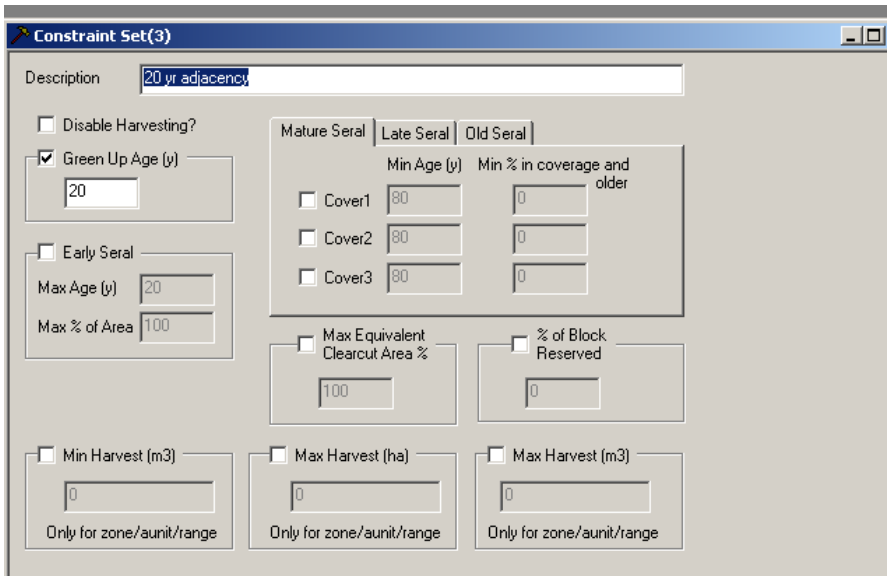
Constraints can be applied at various spatial scales and FPS can accommodate these variations through its hierarchy of spatial units. There are 4 mandatory spatial units: *Range*, *Access Unit*, *Zone* and *Polygon*. In Tutorial 3, the **No Harvest** *CSet* was applied to a *Zone*. This tutorial illustrates how different spatial constraints can be applied at various scales.

1. Create an Adjacency Constraint

1.1. Create a new *RuleSet* called **RSV+Adjacency.** Set the harvest priority to *Age* and copy/paste the flows from the *RuleSet* **NewFlow+RSV.**

1.2. Open the Zone tab in the Browser, double click on **Reserve Zone**, and add the **No Harvest** CSet. Save the Zone.

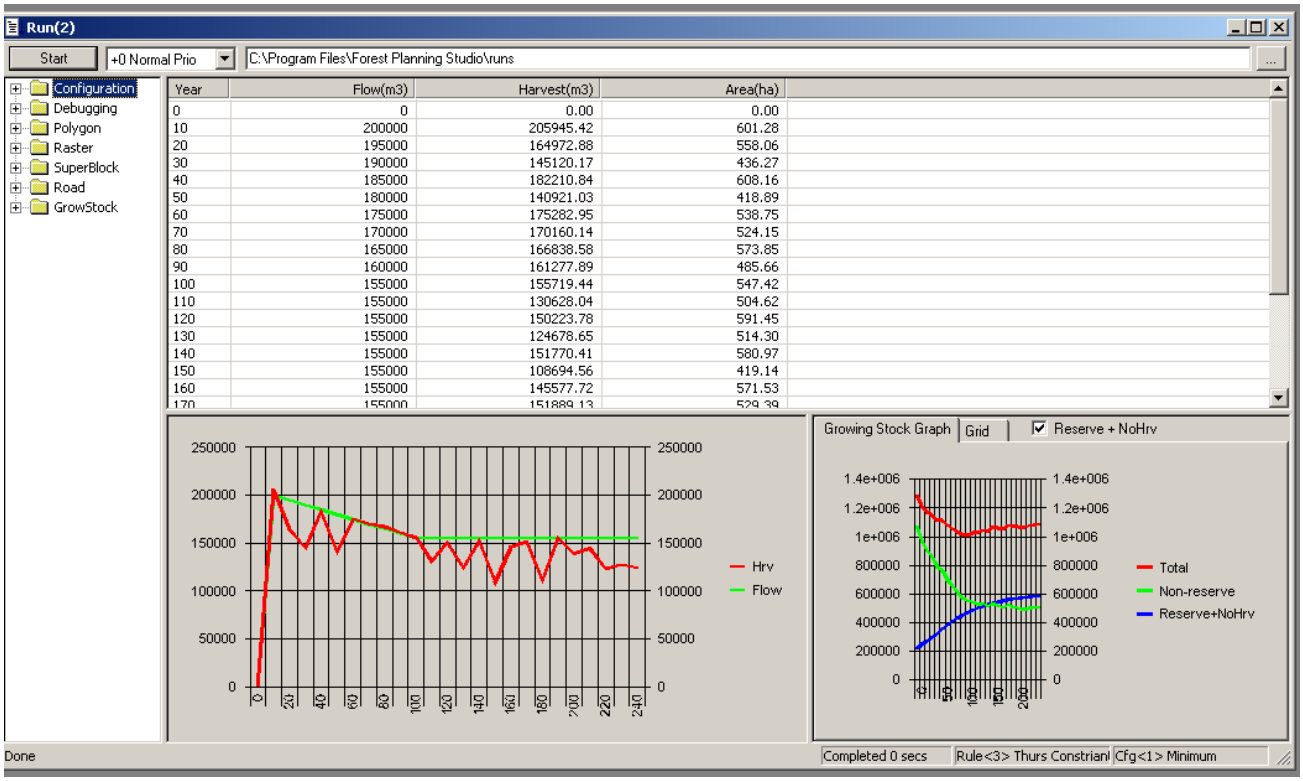
1.3. Using the menu File\New\Constraint Set, create a new *CSet* that imposes a 20-year adjacency constraint. In the Description box, enter **20-yr adjacency**. Check the *Green Up Age (y)* box and enter 20 immediately below it. Save the *CSet* by closing and saving changes.



1.4. Apply the **20-yr Adjacency** *CSet* to *Access Unit 1*. Open the *Browser* and select the *Access Unit (AU)* tab. There should be a single *Access Unit* (*AUnit1*) listed and it should not have any *CSet*s. Double click on *AUnit 1* to open it. On the *Constraints* tab, highlight *Duration* or *Constraint Set*, depress the *Ctrl* and *down-arrow* keys simultaneously. The **20-year adjacency** *CSet* may not be immediately listed. If another *CSet* is listed double click on that *CSet* and a drop down menu should produce the **20-year adjacency** *CSet*. Select the **20-year adjacency** *CSet. Close* the *AUnit 1* Window and accept the changes.

Run the simulation

2.1. The following Figure shows the harvest levels resulting from the **RSV +Adjacency** RuleSet.



Note the “saw-tooth” pattern of the harvest schedule that has peaks approximately 20 years apart (20 year adjacency). This is the classic pattern that develops when adjacency constraints are applied and the model has to struggle to meet that harvest flow targets.

2.2. Modify the harvest flows in the RuleSet **RSV+Adjacency** to match those in the following Figure. These harvest targets are one solution to smoothing out harvest levels throughout the planning horizon. They were derived by trial and error (iteration) and represent one possible solution for a transition to LTSY.

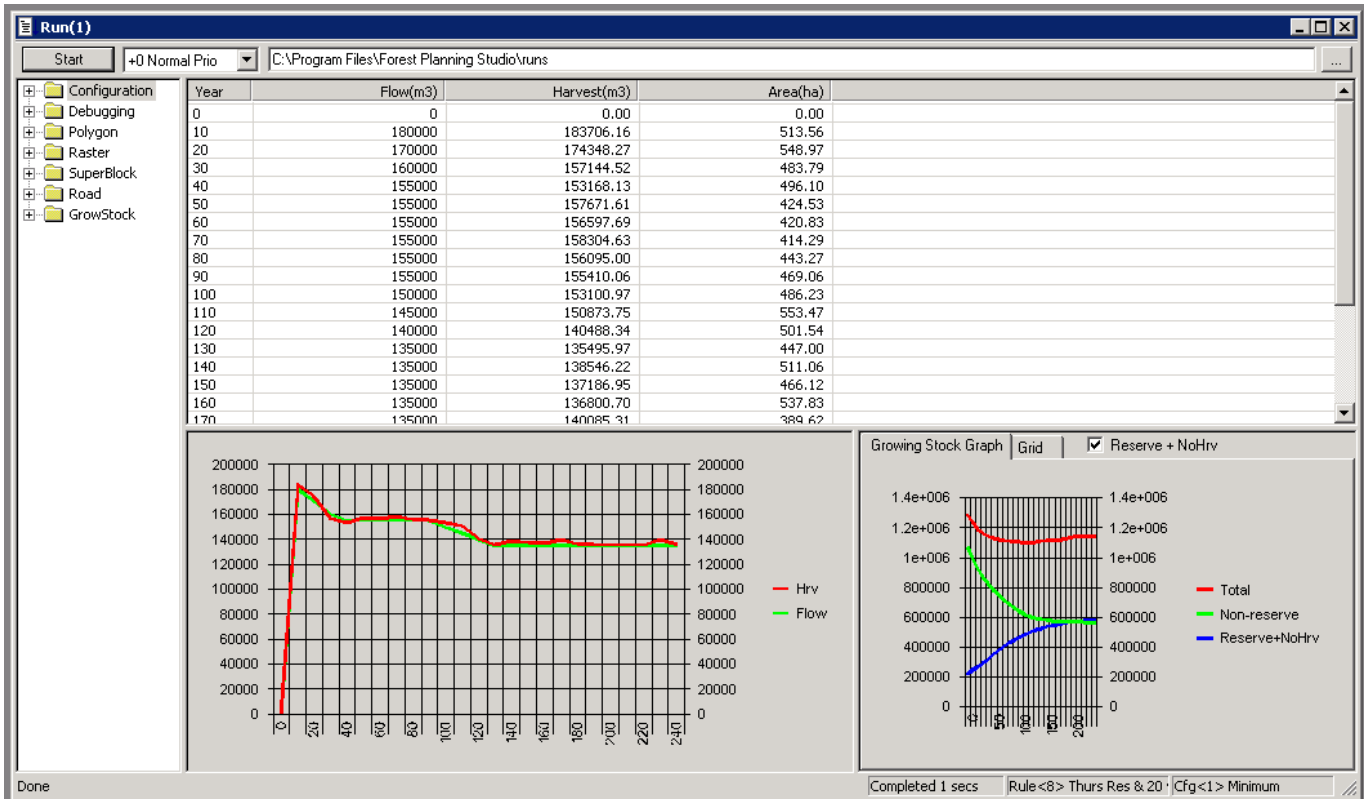


Fig showing modified flows for the **RSV+Adjacency** scenario.

Note that the harvest and the growing stock have stabilized in the long-term, giving us more confidence in the LTSY estimate than found in our previous runs.

ZIP YOUR DATABASE TO BACKUP YOUR WORK BEFORE PROCEEDING TO THE NEXT TUTORIAL

Tutorial 5. Schedule with Sorts

In the previous tutorials, polygons were scheduled for harvest using the oldest-first (*Age*) priority. This was manually set in the *Default Sort* drop-down menu located in the *Parameters* (*Param*) window of the *Rule Set Editor*. This procedure assumes that all polygons within the forest estate are currently and continually accessible, or that accessibility is irrelevant. If access is important, a more realistic schedule is achieved by queuing stands according to their proximity to a mill, although this is also a simplification of operational complexity. The distance to the mill is determined during data base preparation. This tutorial resets the *Default Sort* to illustrate the consequences of queuing based on the minimum distance to the mill priority. In new *Rule Sets* the *Distance* priority is generally set by default.

To view the distances to mill for each polygon in the Gavin Lake database, use the *Viewer Control* and select *Polygon topology*, *Attributes* and *Distance*. Notice that distance radiates from two different road systems that access the area.

Note: Harvest schedules can be further defined by applying the *Default Extra Sort*, although this is not discussed in this tutorial.

1. Select the Reserve & Adjacency Rule Set

3.1. Create a new RuleSet called **Dist+Reserve+Adjacency**.

3.2. Copy your flows from the *RuleSet* **Reserve+Adjacency** and apply the same Csets that were applied under the previous *RuleSet* (no harvest on the reserve zone and 20-yr adjacency on the AU).

Close the Browser.

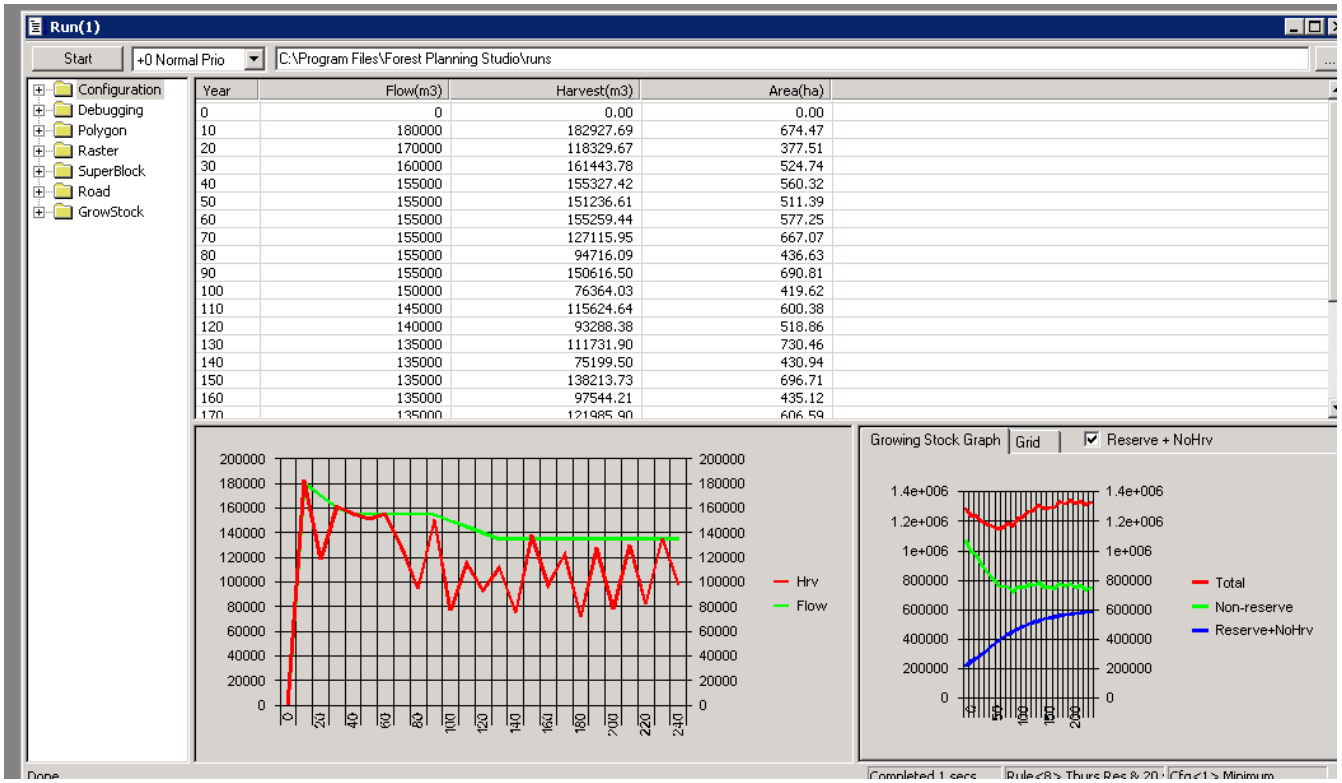
Reset the Default Sort

2.1. In the *Parameters* tab, from the *Default Sort* dropdown menu select *0 – Distance*.

2.2. Save the changes to the *Rule Set* by closing the *Rule Set Editor*.

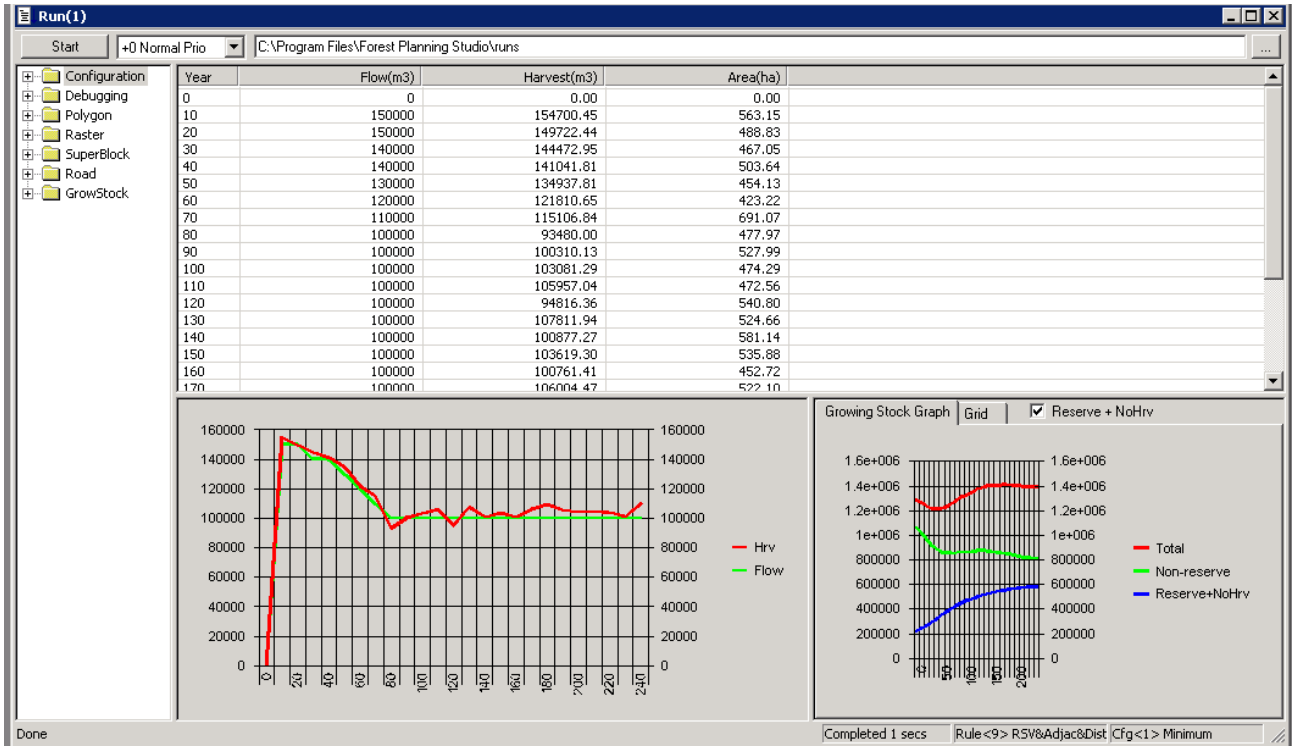
Run the simulation

3.1. The following Figure shows the harvest volumes for **Dist+Reserve+Adjacency** *Rule Set* sorted by *Distance* (harvest flows have not been adjusted to smooth out the flows).



Harvest volumes for **Dist+Reserve+Adjacency** *Rule Set* sorted by *Distance* (harvest flows not adjusted).

3.2. Create a new *Rule Set* and find the maximum harvest volume that meets the objectives (maximize early harvest, maximum 10% decline to LTSY). The following figure shows one solution.



3.3. Activate the *Map Viewer* and observe the harvest schedule in the *Viewer*. Notice how it tends to radiate out from access points at the NW and NE portions of the forest estate.

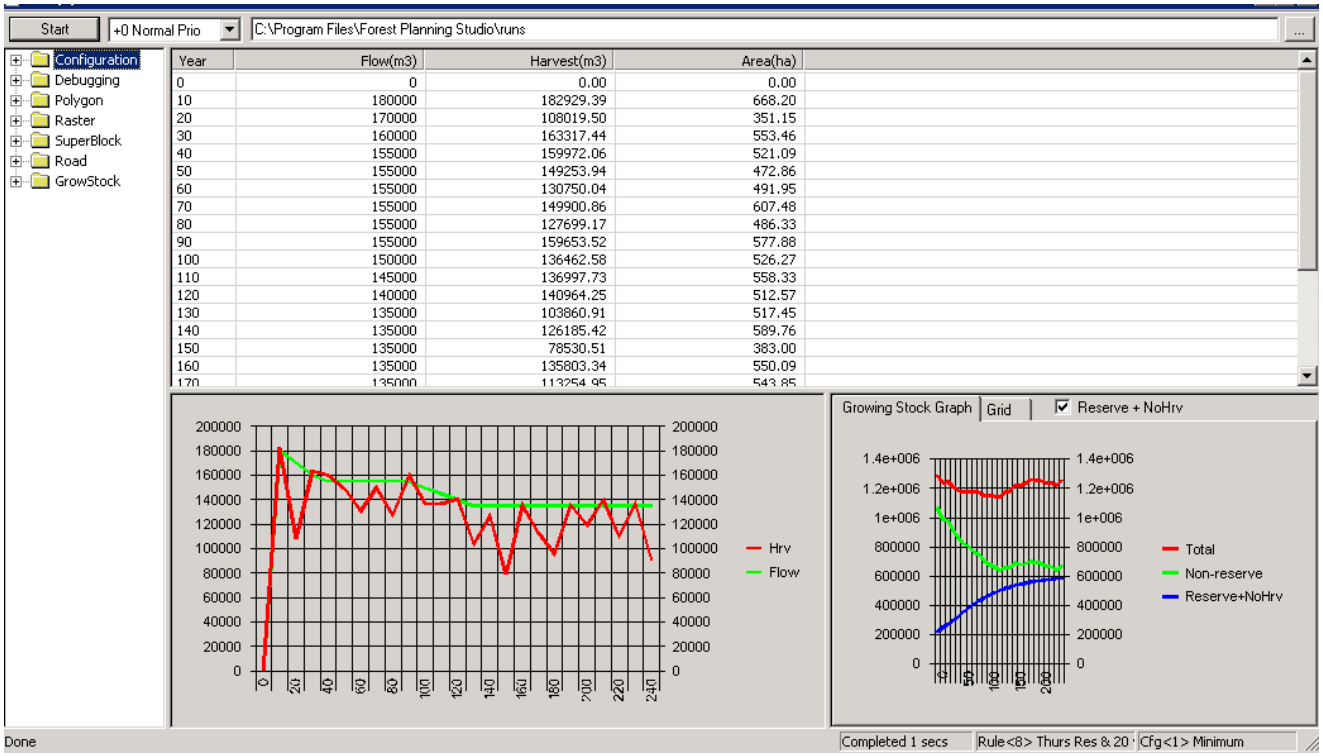
2. Random Harvest Priority/Sort

3.3. Create a new *RuleSet* called **Rand+Reserve+Adjacency**. Copy and paste the flows from the *RuleSet* **Dist+Reserve+Adjacency** and apply the same Csets that were applied under the previous *RuleSet* (no harvest on the reserve zone and 20-yr adjacency on the AU).

3.4. In the *Parameters* tab, from the *Default Sort* dropdown menu select 2 – *Random*.

Run the simulation

3.5. The following Figure shows a harvest schedule for the **Rand+Reserve+Adjacewncy** *Rule Set* sorted by *Random* (harvest flows not adjusted).



Try running the simulation 5-6 times. Each time you will get a different solution. This is handy for estimating variation in the harvest schedule.

3.6. Iterate a new harvest schedule by changing the flow targets until you achieve the objectives (maximize early harvest subject to a maximum 10% decline to LTSY). Left as a student exercise.

Tutorial 6. Schedule Long Rotations

Forest Planning Studio models long rotation lengths at the stand level through the Stand Group settings for minimum age.

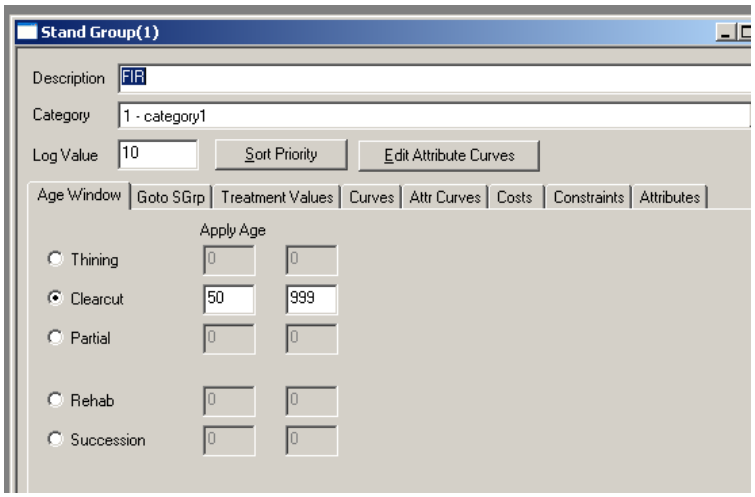
1. Long Rotations

You will be changing the minimum harvest age of a stand group, and since stand groups are independent of the RuleSets (unlike Csets), you can't replicate previous runs that used a minimum harvest age of 50 years. However, in a subsequent tutorial you will change the minimum harvest age back to its original value. You just need to remember the correct minimum harvest age to be used in each RuleSet. If changes to the stand groups become substantial (lots of work to reverse) then it is better to make a new working copy of the database so that the original runs are preserved in the original database. We will do this in the latter tutorials that use partial cutting and commercial thinning.

Open GavinTut.mdb with FPS create a new RuleSet called **Long Rotations**. Copy and paste the flows from the RuleSet **Dist_Reserve_Adjacency** and paste them into **Long Rotations.** Add the 20-yr adjacency Cset to the access unit (AU) and the no harvest Cset to the Reserve Zone. Also make sure that the Default Sort is Distance.

1.1. From the *Browser* window select the *SGrp* folder.

1.2. Select *SGrp 1 - FIR* by double clicking on it. The *Stand Group 1 – FIR* window should appear as below.



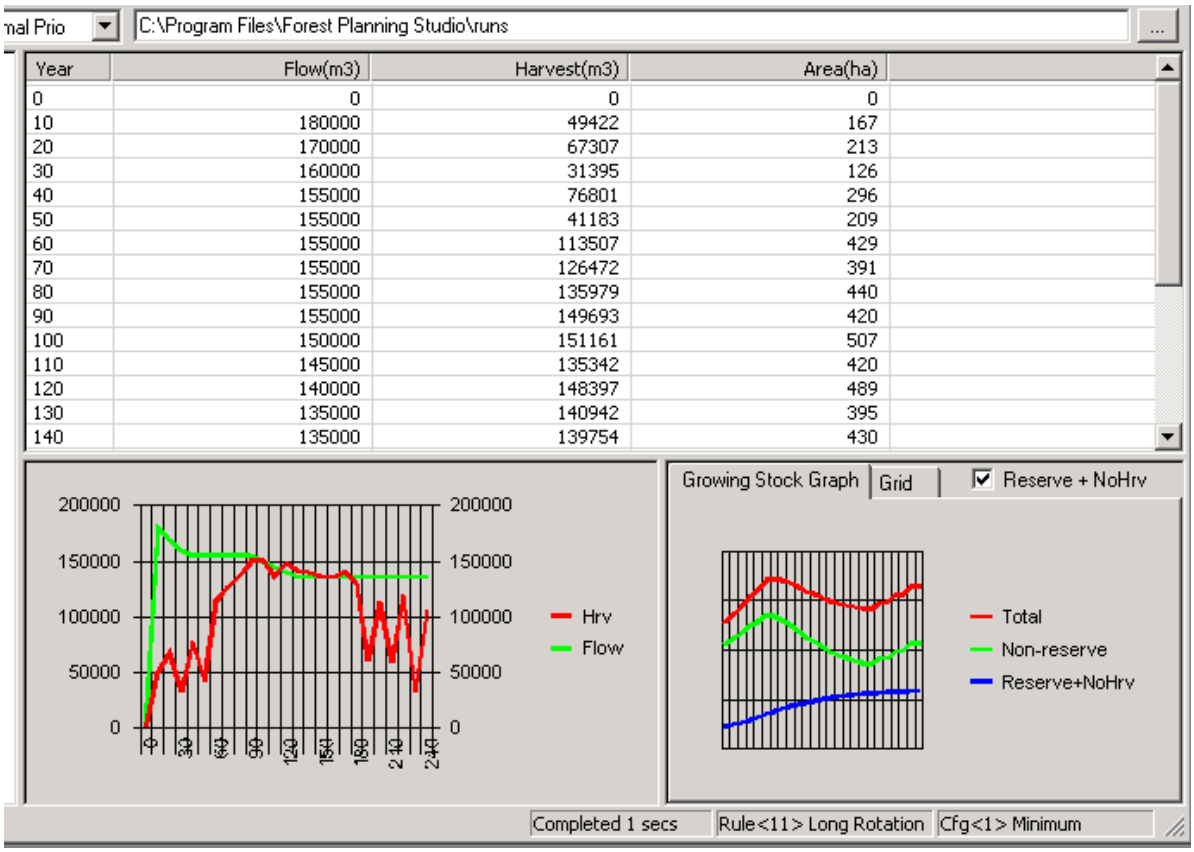
1.3. Select the *Age Window*; *Clearcut* should already be highlighted. Reset the *Minimum* harvest age to **180** years.

1.4. Select the *Goto SGrp* folder and again *Clearcut* should be selected. Open the dropdown menu adjacent to the *Clearcut* treatment. Select **<myself>**. With this setting all stands within Stand *Group 1 – FIR* will be harvested between the ages of 180 and 999 years. Once harvested these stands will return as *Stand Group 1 – FIR* for the same treatment in the next rotation.

1.5. Close the *Stand Group 1 – FIR* window and accept the changes.

Run the simulation

2.1. The following Figure shows the harvest volumes for **Long Rotations** sorted by *Distance* with a **minimum harvest age of 180** in *Stand Group 1 – FIR* type stands.



2.2. Create a new *Rule Set* called **Long Rotations 2** (Sort= Distance and the same Csets as above) and find a harvest schedule that smoothes out the large peaks and valleys. It will have a lower harvest level in the first 50 years than in the remaining periods. Watch your growing stock to see if long-term harvests can be increased or if they need to be decreased. No answer is provided – this is your exercise to adjust the harvest flows.

Tutorial 7. Set Minimum Levels of Old Forest

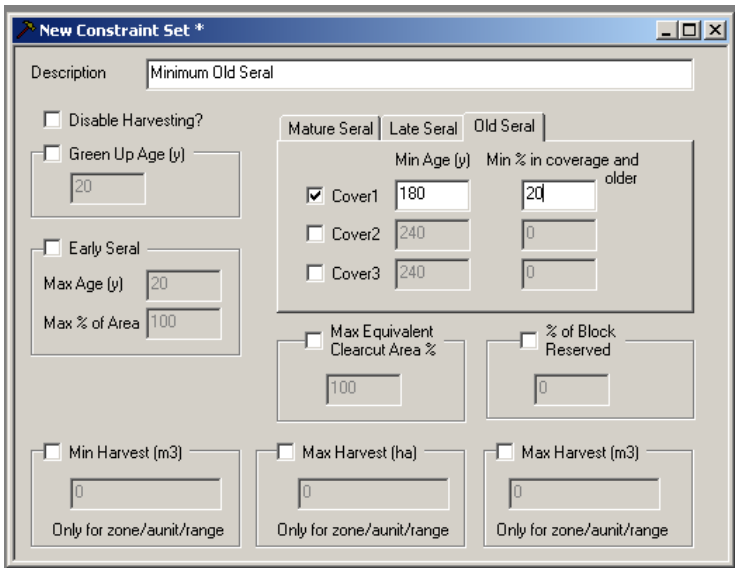
In FPS another method of maintaining portions of old forest within forest estates is to define (ages) and set minimum portions of the estate as old forest.

Create a new *Rule Set* called **Minimum Old Seral** by copying flows from **Dist+Reserve+Adjacency** with the *Distance* sort. The *minimum* and *maximum* harvest ages should be **50** and **999** years, respectively. Be sure to update the No Harvest CSet on the Reserve Zone and the adjacency CSet on the Access Unit in your new Rule Set.

1. Use the procedures described in Tutorial 3 to create a *CSet*, named **Minimum Old Seral**.

2. Apply one constraint.

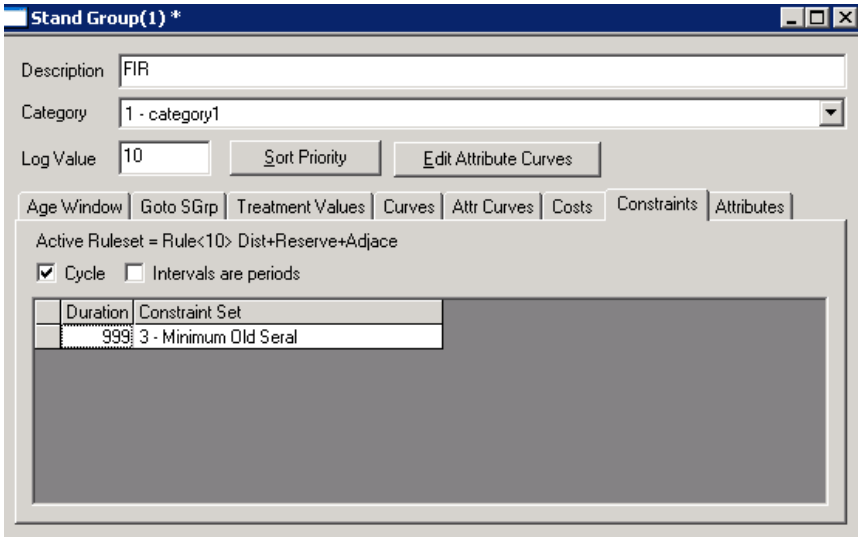
2.1. In the CSet window, select the *Old Seral* tab. Check the *Cover1* box, the *Min Age (y)* and *Min % in coverage and older* boxes should become highlighted. Enter a minimum age of **180 years** and minimum percent coverage of **20%**.



2.2. Close the *CSet* window and accept the changes.

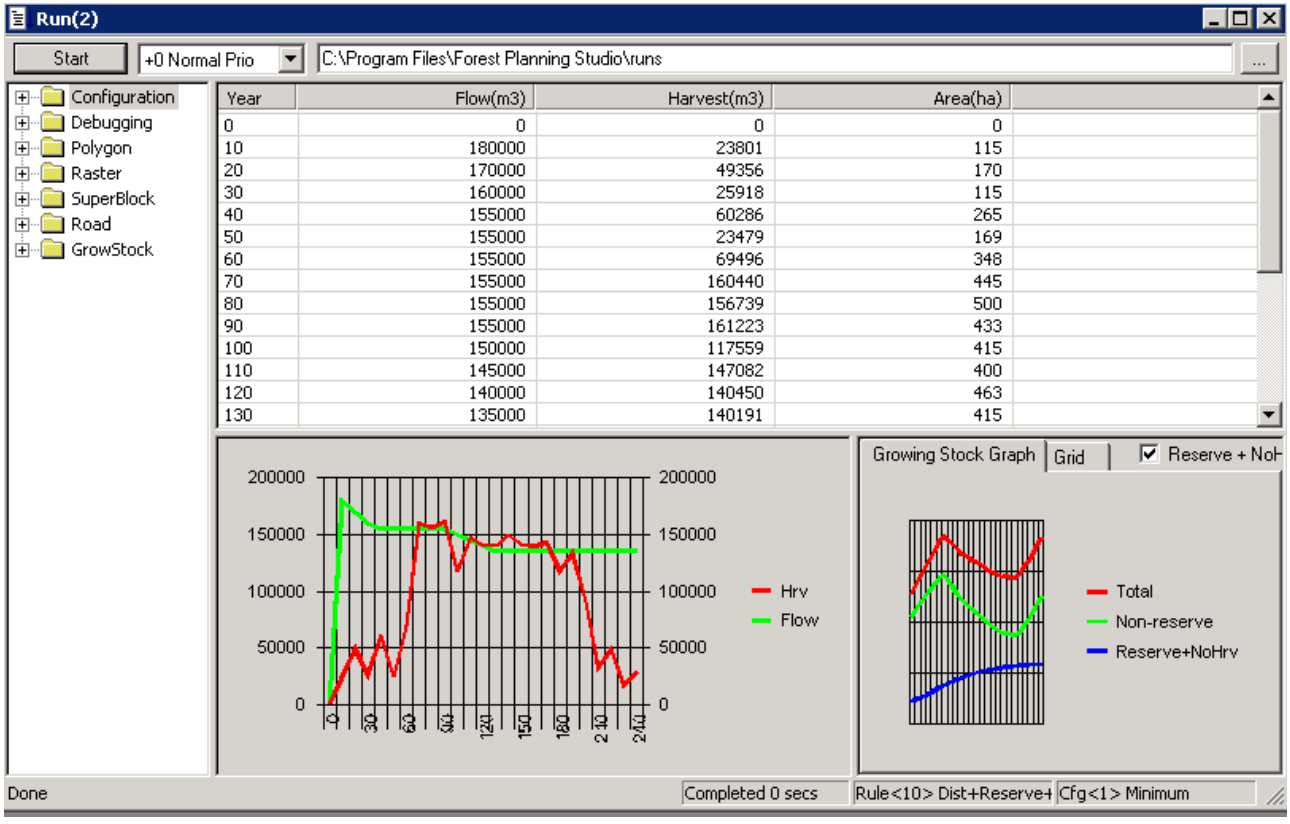
Apply the *CSet*

3.1. Apply the **Minimum Old Seral** *CSet* to *Stand Group 1 – FIR*.



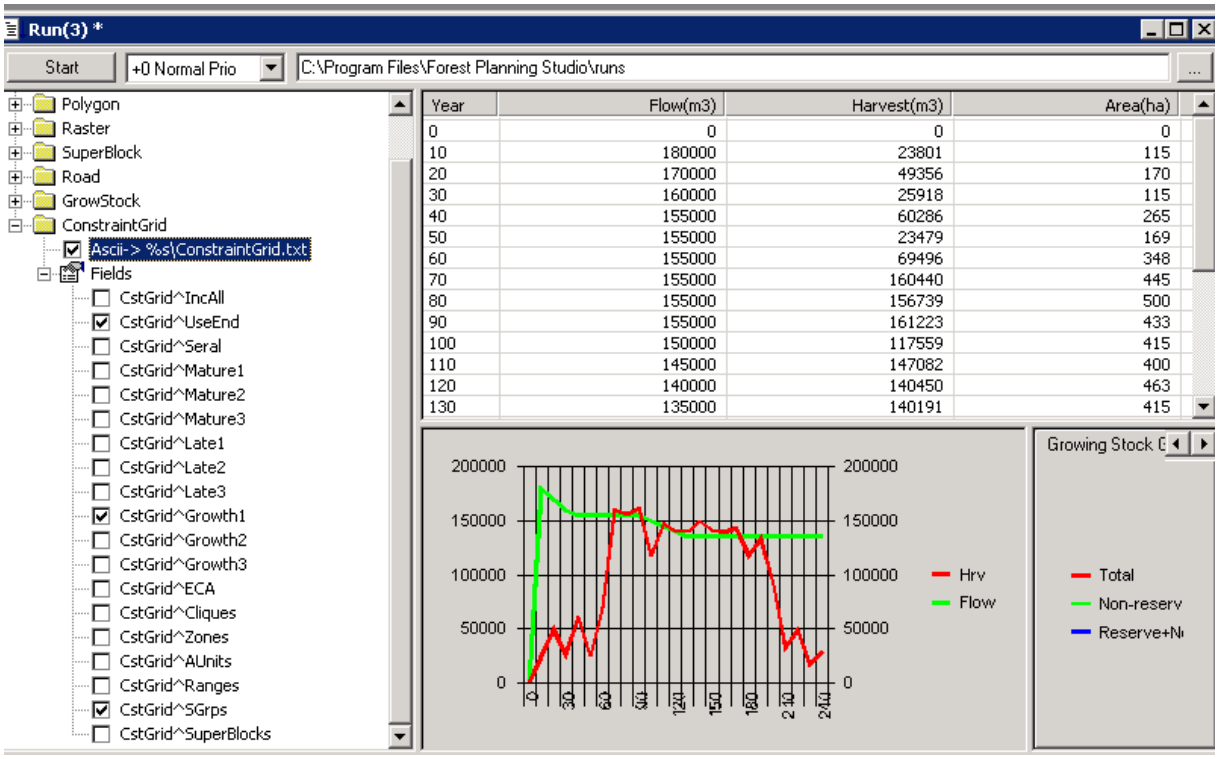
Run the simulation

4.1. The following Figure shows the harvest volumes using the **Minimum Old Seral** RuleSet with the *Distance* sort.

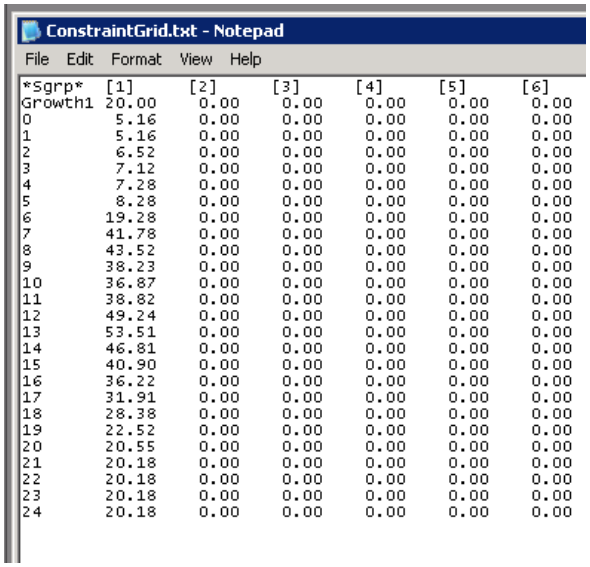


4.2. To understand how FPS applied this Rule Set:

4.2.1. With the Viewer control set to *Polygon topology*, *Attributes* and *Age* check the Map Viewer to see that 20% of the forest appears as ages 180-years or greater. Note: another method of checking these results, and other results, is to generate text files. First append the *ReportConstraintsGrid* module in the configuration window. When the run window is opened, expand the tree structure under *ConstraintGrid*, and check the boxes as shown below. After the run is made, double click on *ConstraintGrid.txt* – this will open the text file with Notepad. This file reports targets and achieved values for all constraints and spatial units that were selected with the check boxes. Subsequent runs will include the *constraints.txt* file provided the module is included in the configuration window and the appropriate boxes are checked in the run window. Other modules, such as *ReportVolumesGrid*, can be appended to the configuration window to produce similar text files. These files can easily be imported or copied into a spreadsheet for analysis and graphing.



The Constraint Grid report is shown in the following Figure. The first column is the period, followed by each stand group. For stand group 1- Fir, the minimum old seral was 20% and this target value appears just before period 0. The following rows show the percentage of 180+ year old stands (by area) in each period. The minimum taget of 20% isn't reached until period 7 (41.78%), so no harvesting of stand group 1 – Fir occurred before this period. The last few period are very close to 20%, suggesting the constraint is also binding during these periods.


ConstraintGrid.txt - Notepad

File Edit Format View Help

Sgrp	[1]	[2]	[3]	[4]	[5]	[6]
Growth1	20.00	0.00	0.00	0.00	0.00	0.00
0	5.16	0.00	0.00	0.00	0.00	0.00
1	5.16	0.00	0.00	0.00	0.00	0.00
2	6.52	0.00	0.00	0.00	0.00	0.00
3	7.12	0.00	0.00	0.00	0.00	0.00
4	7.28	0.00	0.00	0.00	0.00	0.00
5	8.28	0.00	0.00	0.00	0.00	0.00
6	19.28	0.00	0.00	0.00	0.00	0.00
7	41.78	0.00	0.00	0.00	0.00	0.00
8	43.52	0.00	0.00	0.00	0.00	0.00
9	38.23	0.00	0.00	0.00	0.00	0.00
10	36.87	0.00	0.00	0.00	0.00	0.00
11	38.82	0.00	0.00	0.00	0.00	0.00
12	49.24	0.00	0.00	0.00	0.00	0.00
13	53.51	0.00	0.00	0.00	0.00	0.00
14	46.81	0.00	0.00	0.00	0.00	0.00
15	40.90	0.00	0.00	0.00	0.00	0.00
16	36.22	0.00	0.00	0.00	0.00	0.00
17	31.91	0.00	0.00	0.00	0.00	0.00
18	28.38	0.00	0.00	0.00	0.00	0.00
19	22.52	0.00	0.00	0.00	0.00	0.00
20	20.55	0.00	0.00	0.00	0.00	0.00
21	20.18	0.00	0.00	0.00	0.00	0.00
22	20.18	0.00	0.00	0.00	0.00	0.00
23	20.18	0.00	0.00	0.00	0.00	0.00
24	20.18	0.00	0.00	0.00	0.00	0.00

4.2.2. Try smoothing out the harvest flows to get a more desirable harvest schedule. For a starting point, try 40,000 for years 10-60 and 110,000 for years 70-240.

Left as a Student Exercise

Tutorial 8. Schedule Partial Cut Harvests

To this point, clearcutting has been the only silviculture treatment considered. FPS can apply five basic treatments to polygons. Three of these treatments (thinning, clearcut and partial cut) generate harvest volumes while two treatments (succession and rehabilitation) do not. There are important differences in how FPS applies these various treatments and this tutorial applies a partial cut harvest as an example of how silviculture treatments can be simulated.

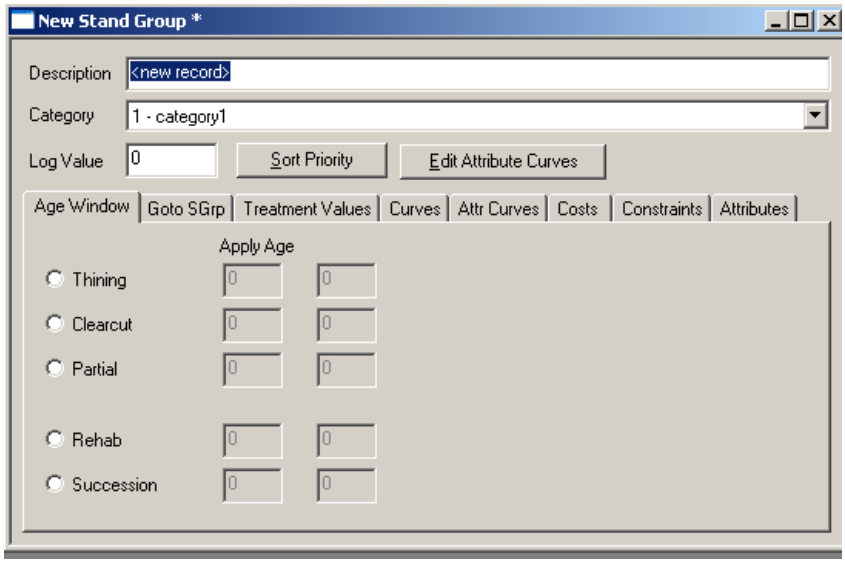
Because we will be making substantial changes to the stand groups, you need to make a copy of GavinTut.mdb and rename it **GavinTut_2.mdb**. Open GavinTut_2.mdb with FPS and use this new database for this tutorial. Open the RuleSet window and delete all the RuleSets except **Minimum Old Seral**. To delete a RuleSet, click on its tab and then right click anywhere in the RuleSet and select *Delete RuleSet* from the drop down menu.

Create a new RuleSet named **Partial Cut** and make sure Distance is set as the default sort. Copy the flows from the RuleSet **Minimum Old Seral.** In the Browser, apply the No Harvest CSet to the Reserve Zone and the 20-yr Adjacency CSet to the Access Unit.

1. Create a Partial Cut Stand Group

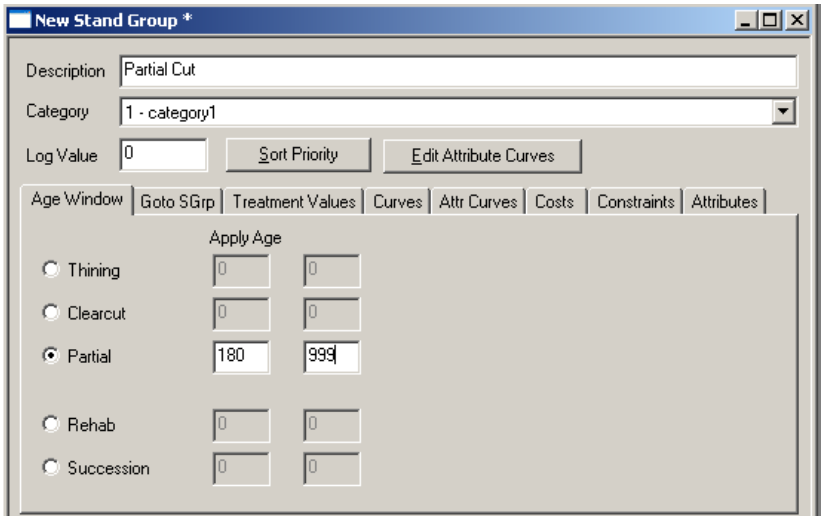
Stand groups are used to describe the silviculture treatments that are applied to polygons. Stand groups are linked to the volume-age curves.

1.1. Select *File*, then *New*, then *Stand Group*. The New Stand Group window should appear.



Name the new Stand Group **Partial Cut**.

1.2. Select the *Age Window*. Notice the five silviculture treatments options available in FPS. Select the *Partial* cut treatment and set a *Minimum* of **180** and a *Maximum* of **999**. These age limits are set to ensure that the partial cut is applied within a period that is consistent with the associated Yield Curve. A more detailed discussion of Yield Curves is provided in Tutorial 8.

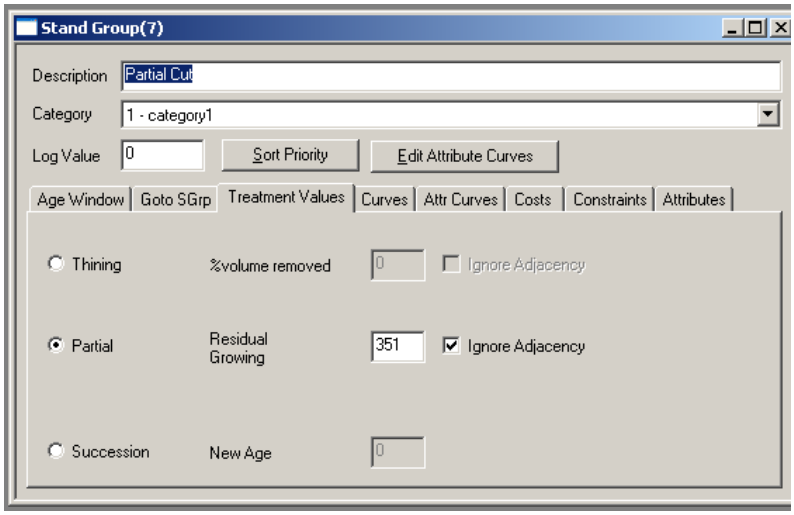


1.3. Select the *Goto SGrp* tab. Notice the five treatments and that the treatment *Partial* should already be selected. The box to the right of this should say **<*myself*>** indicating that after a polygon has been harvested it will be return to the same Stand Group, i.e. it will *Goto* the **Partial Cut** Stand Group.

1.4. Select the *Treatment Values* tab. Notice that there are three conditions, each associated with a treatment. Set the *Residual Growing Stock* to **351** m3/ha. **Partial Cut** stands may now be harvested so long as a residual growing stock of 351 m3/ha is retained. This level of residual growing stock is based on an arbitrary objective of maintaining mule deer winter range. Guidelines indicate that 70% and 90% of growing stock should be maintained in partial harvests within mule deer winter range. The lower bounds being appropriate when there is a high portion of suitable winter habitat within the planning area.

To be more specific about how FPS applies partial cuts, in this example, if a polygon is **180** years or older, it is harvested down to the *Residual Growing Stock* of **351** m3/ha as set in the *Treatment Values* tab. After harvest the new stand age is set to the age where the *Residual Growing Stock* occurs on the Volume/Age curve, in this example **130** years. In this example, every 50 years 74m3/ha are harvested, and the age of the polygon cycles between 180 and 130 years.

1.4.1. Checkmark the *Ignore Adjacency*.



1.5. Select the *Curves* tab. Notice that there two options; *Age* (volume age curve) and *CCE* (clear cut equivalency).

1.6. Click on the drop down arrow at the right of the *Age* box and select the **Partial Cut** *Curve*. Leave the *CCE* box blank.

1.7. Select the *Constraints* tab. Ensure that no constraints are selected for this Stand Group.

1.8. Close and accept the new **Partial Cut** Stand Group.

2. Partial Cut in the First Rotation

The **Partial Cut** Stand Group and **Partial Cut** Growth & Yield Curve describe the management regime for partially cut stands. Currently there are no partially cut stands. To confirm this, open the Viewer and expand *Polygon topology view* in the *Viewer Control*. Select *Stand Group* and expand its legend. The **Partial Cut** Stand Group should be listed in the legend but no polygons will be identified with this *Stand Group* in the *Map Viewer*.

To apply partial cuts the desired polygons, their Stand Group must be changed to the Partial Cut Stand Group just created or their existing Stand Groups need to be edited to apply a partial cut. In this example the existing Stand Group (Stand Group 1 – FIR) will be changed to a partial cut system.

Polygons can be changed individually or through Stand Group edits (individual polygon changes will be discussed in more detail in Tutorial 9, fencing edits are discussed in more detail in Tutorial 10). In this tutorial the changes will be applied to all *Stand Group 1 – FIR* polygons.

2.1. From the *Browser* window select *SGrp* tab.

2.2. Select *SGrp 1 - FIR* with a double click.

2.3. Select the *Age Window*. The *Stand Group 1 – FIR* window should appear as below. Select *Partial*, set the *Minimum* and *Maximum* ages to **180** and **999** respectively.

2.4. Select the *GoTo SGrp* window. From the drop down menu select **<Partial Cut>.** After each Stand Group 1 – FIR stand is partial-cut, the stand will become part of the **Partial Cut** Stand Group and will grow and yield volume according to the **Partial Cut** Growth and Yield Curve. All future harvests will be partial cuts according to the **Partial Cut** Stand Group.

2.5. Right clicking on the **Partial Cut** stand group in the *GoTo SGrp* window will open this stand group. Check that the *Values* tab shows the *Residual Growing Stock* is **351** m3/ha and that the *Ignore Adjacency* box is checked. Close the Partial Cut window.

2.6. On the FIR stand group, select the Treatment Values tab. Enter 351 as the residual growing stock and check the ignore adjacency box.

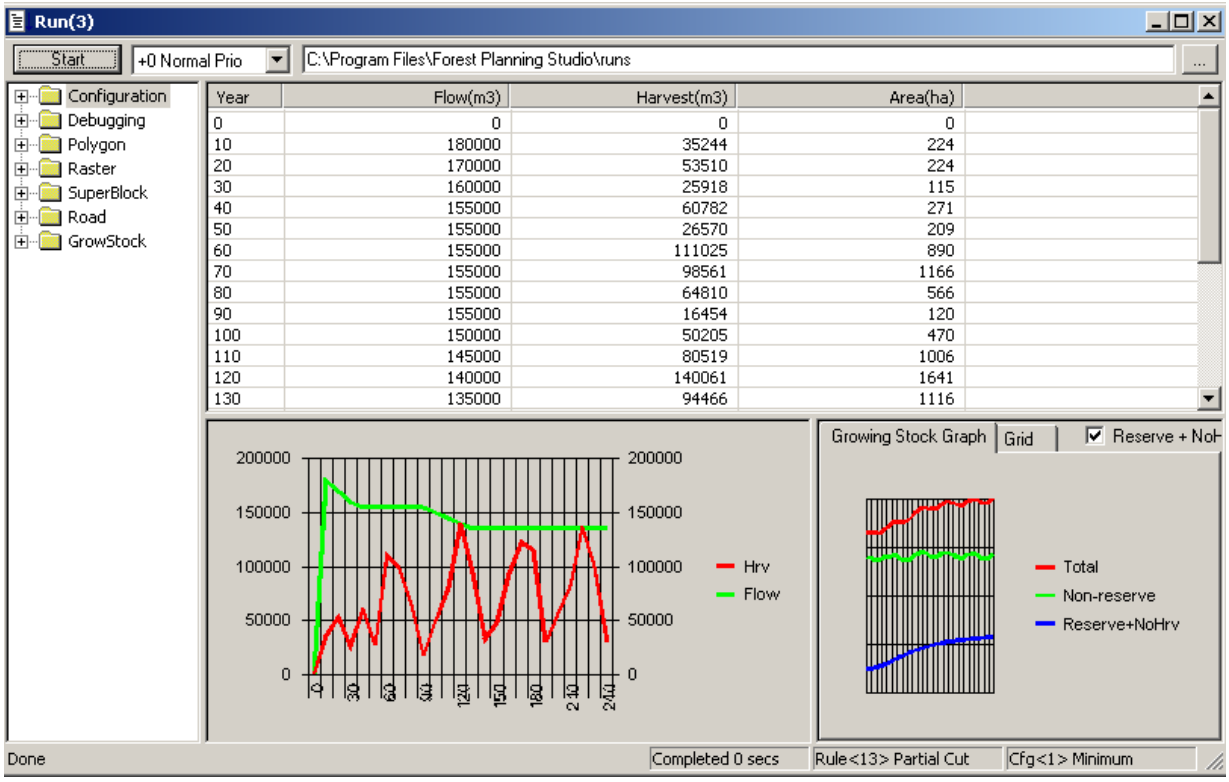
2.7. Select the Curves tab and in the Age box select the Partial Cut curve. Leave the *CCE* box blank.

2.8. Close the stand group window and accept the changes.

Run the Simulation

After the simulation is complete confirm that **Stand Group 1 – FIR** was replaced by the **Partial Cut** *Stand Group*. Scroll through the various planning periods within the *Map Viewer* as described in Tutorial 2 (3.4 – 3.44).

3.1. The **Partial Cut** RuleSet with the *Distance* sort set resulted in the following harvest levels.



To confirm that the model is working correctly, open the Viewer and drag the run into it. Select Stand Group in the Viewer Control and cycle through the periods. You should see that Stand Group 1 – FIR is converted to the Partial Cut stand group. Now select Attribute – Output Only – Treat_State. As you cycle through the periods you can observe which polygons are clear cut, partially cut and those that continue to grow undisturbed. Finally, select Attribute - Age in the Viewer Control, and expand the Format tree (near

the top of the Viewer Control) and check the Text box. As you cycle through the periods you will see that when stands to be partially cut reach 180 years of age, the age is reset to 130 years.

3.2. Create a new *Rule Set* named **Partial Cut Flow** (with the same sort and CSets as **Partial Cut**) and smooth out the harvest schedule. You will need to start low and take a few steps up to LTSY.

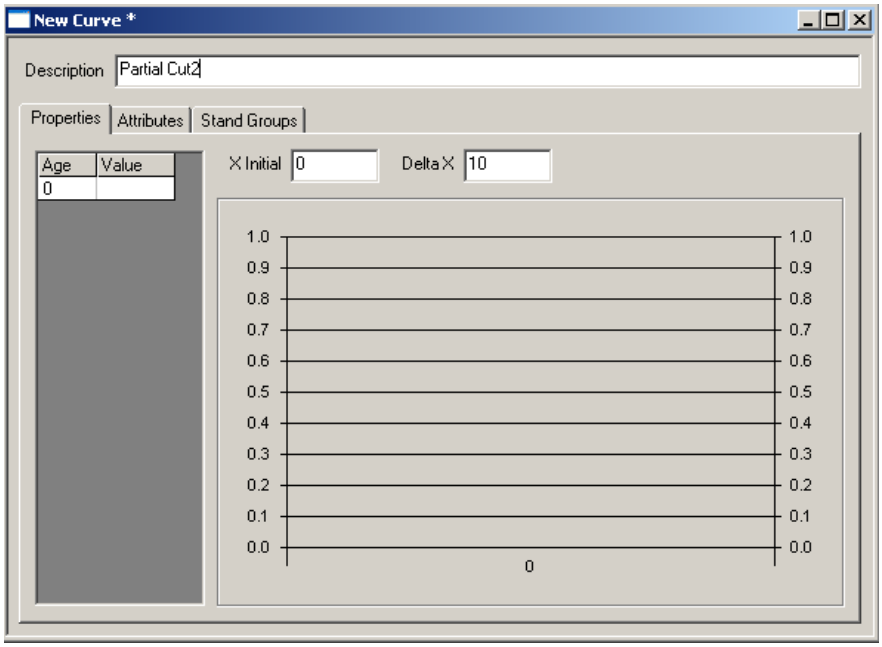
Tutorial 9. Construct a Yield Curve

In the previous tutorial the **Partial Cut** curve estimating growth and yield was provided. This estimate was derived by modifying even-aged-stand curves to the partial cut (uneven-age stands) based on the proportion of volume cut. For stands that are evenly proportioned to different age-classes, a single curve is sufficient. Where the proportions of age-classes change (such as the period when a stand is being converted from even-aged to uneven-aged) a more complicated series of yield curves is necessary. With FPS this requires a series of Stand Groups because each Stand Group is associated with a single Yield Curve.

Output from stand-level yield models such as TYPSY, VDYP and FORECAST, or single-tree based models such as TASS can be imported into FPS. This tutorial provides a simple example of how to create a growth and yield curve (*Volume/Age*). This procedure can also be used to create *ECA(CCE)* or *UserATtr/Age* curves.

1. Create a New Curve

1.1. Select *File*, then *New*, then *Curve*, and then *OK* to accept. The *New Curve* window should appear. Name the curve **Partial Cut2**. Select the *Properties* tab. The Curve window should look similar to the figure below.



1.2. Enter an *X Initial* of **130** years.

1.3. Highlight the *Age* or *Value* box then *Ctrl + Down Arrow* to create cells to enter values. By default each click should add a single 10-year-interval (Delta X default is 10 although any integer value can be applied, for example Equivalent Clearcut Area [ECA] curves often use 1, 3 or 5 year intervals). Create 17 – 10-year intervals. Each yield *Value* must be entered individually.

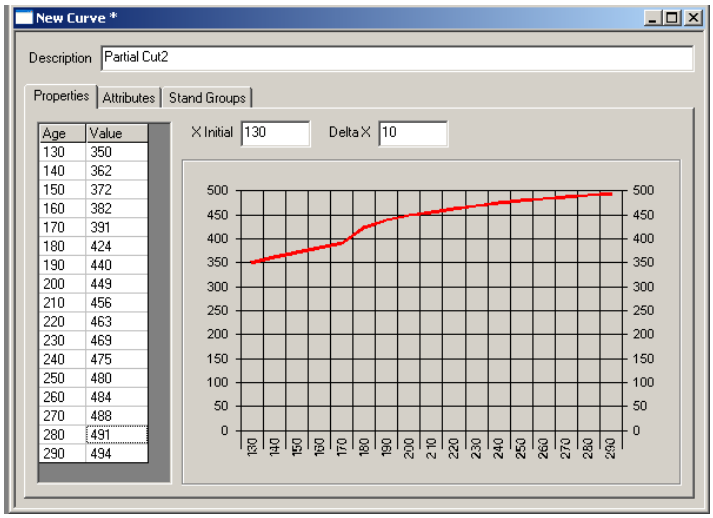
1.4. Calculate the yield values

1.4.1. First, it is important to understand how FPS describes partially cut stands. After each partial cut the stand age reverts to the equivalent *Residual Growing Stock* age (this is different from *Thinning* where the stand retains its pre-cut age). The **Partial Cut** curve is an even-aged

stand up to 180-years. At 180-years the volume is 438m3/ha. With the mule deer winter habitat objective of maintaining 80% of the original stand, the Residual Growing Stock is 438m3/ha * 0.8 = 351 m3/ha. For this reason, the *Minimum Age* is set to **180** years. After age 180, the curve is constructed to describe the two-age-class stand created by the first partial cut of the even-aged stand. This is accomplished by proportioning the percentage of *Residual Growing Stock* and New Growing Stock (the amount of volume harvested) relative to the original total stand volume. The Residual Growing Stock is grown at the rate appropriate for the original stand (180-years). The New Growing Stock (regeneration) is grown at the rate of a newly regenerated stand. The values and calculations used to create the **Partial Cut** yield curve used in the previous tutorial are shown below. The final two columns show the values that were entered into the **Partial Cut** curve.

Partial Cut First Pass						
Even-Age	Even-Age Yield	Top Layer Yield	Second Layer Age	Second Layer Yield	*Stand Age*	*Stand Volume*
180	438	350	0	0	*130*	*350*
190	452	362	10	0	*140*	*362*
200	465	372	20	0	*150*	*372*
210	477	382	30	0	*160*	*382*
220	489	391	40	0	*170*	*391*
230	500	400	50	24	*180*	*424*
240	511	409	60	32	*190*	*440*
250	512	410	70	39	*200*	*449*
260	513	410	80	46	*210*	*456*
270	514	411	90	52	*220*	*463*
280	515	412	100	57	*230*	*469*
290	516	413	110	62	*240*	*475*
300	516	413	120	67	*250*	*480*
310	516	413	130	71	*260*	*484*
320	516	413	140	75	*270*	*488*
330	516	413	150	78	*280*	*491*
340	516	413	160	82	*290*	*494*

The **Partial Cut** curve is shown below.



1.4.2. Use the following three tables to construct three new yield curves (**Partial Cut2**, **Partial Cut3**, **Partial Cut4**) for the second, third and fourth partial cuts. The volume-age values for these curves is in the final two columns of each table.

Partial Cut Second Pass								
Even-Age	Even-Age Yield	Top Layer	Second Layer Age	Second Layer Yield	Third Layer Age	Third Layer Yield	*Stand Age*	*Stand Volume*
220	489	293	100	57	0	0	*130*	*351*
230	500	300	110	62	10	0	*140*	*362*
240	511	307	120	67	20	1	*150*	*374*
250	512	307	130	71	30	7	*160*	*385*
260	513	308	140	75	40	15	*170*	*398*
270	514	308	150	78	50	24	*180*	*410*
280	515	309	160	82	60	32	*190*	*422*
290	516	310	170	85	70	39	*200*	*433*
300	516	310	180	88	80	46	*210*	*443*
310	516	310	190	90	90	52	*220*	*452*
320	516	310	200	93	100	57	*230*	*460*
330	516	310	210	95	110	62	*240*	*467*
340	516	310	220	98	120	67	*250*	*474*
350	516	310	230	100	130	71	*260*	*481*
360	516	310	240	102	140	75	*270*	*487*
370	516	310	250	102	150	78	*280*	*490*
380	516	310	260	103	160	82	*290*	*494*

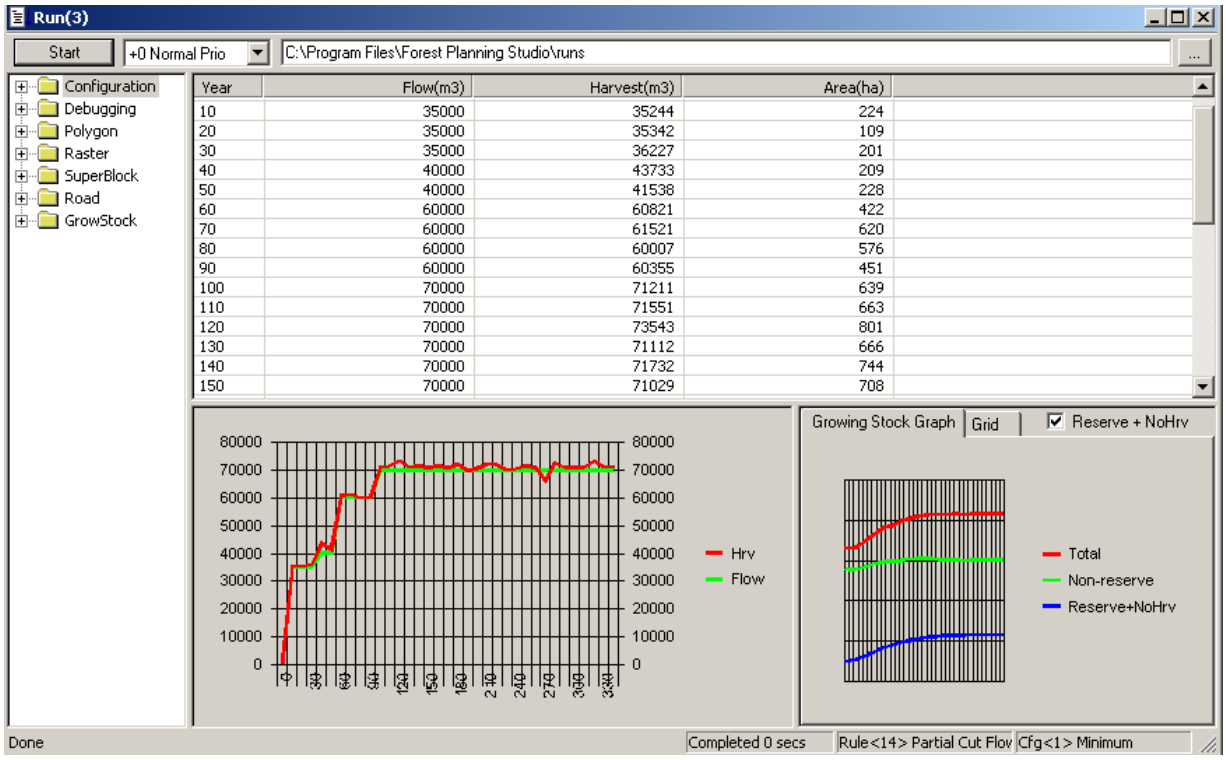
Partial Cut Third Pass										
Even-Age	Even-Age Yield	Top Layer	Second Layer Age	Second Layer Yield	Third Layer Age	Third Layer Yield	Fourth Layer Age	Fourth Layer Yield	*Stand Age*	*Stand Yield*
310	516	206	190	90	90	52	0	0	*130*	*349*
320	516	206	200	93	100	57	10	0	*140*	*357*
330	516	206	210	95	110	62	20	1	*150*	*365*
340	516	206	220	98	120	67	30	7	*160*	*378*
350	516	206	230	100	130	71	40	15	*170*	*393*
360	516	206	240	102	140	75	50	24	*180*	*407*
370	516	206	250	102	150	78	60	32	*190*	*419*
380	516	206	260	103	160	82	70	39	*200*	*430*
390	516	206	270	103	170	85	80	46	*210*	*440*
400	516	206	280	103	180	88	90	52	*220*	*449*
410	516	206	290	103	190	90	100	57	*230*	*457*
420	516	206	300	103	200	93	110	62	*240*	*465*
430	516	206	310	103	210	95	120	67	*250*	*472*
440	516	206	320	103	220	98	130	71	*260*	*478*
450	516	206	330	103	230	100	140	75	*270*	*485*
460	516	206	340	103	240	102	150	78	*280*	*490*
470	516	206	350	103	250	102	160	82	*290*	*494*

Partial Cut Fourth Pass												
Even-Age	Even-Age Yield	Top Layer	Second Layer Age	Second Layer Yield	Third Layer Age	Third Layer Yield	Fourth Layer Age	Fourth Layer Yield	Fifth Layer Age	Fifth Layer Yield	*Stand Age*	*Stand Yield*
410	516	103	290	103	190	90	100	57	0	0	*130*	*354*
420	516	103	300	103	200	93	110	62	10	0	*140*	*361*
430	516	103	310	103	210	95	120	67	20	1	*150*	*370*
440	516	103	320	103	220	98	130	71	30	7	*160*	*382*
450	516	103	330	103	230	100	140	75	40	15	*170*	*397*
460	516	103	340	103	240	102	150	78	50	24	*180*	*411*
470	516	103	350	103	250	102	160	82	60	32	*190*	*422*
480	516	103	360	103	260	103	170	85	70	39	*200*	*433*
490	516	103	370	103	270	103	180	88	80	46	*210*	*443*
500	516	103	380	103	280	103	190	90	90	52	*220*	*452*
510	516	103	390	103	290	103	200	93	100	57	*230*	*460*
520	516	103	400	103	300	103	210	95	110	62	*240*	*467*
530	516	103	410	103	310	103	220	98	120	67	*250*	*474*
540	516	103	420	103	320	103	230	100	130	71	*260*	*481*
550	516	103	430	103	330	103	240	102	140	75	*270*	*487*
560	516	103	440	103	340	103	250	102	150	78	*280*	*490*
570	516	103	450	103	350	103	260	103	160	82	*290*	*494*

Create three new *Stand Groups* (**Partial Cut2**, **Partial Cut3**, and **Partial Cut4**) and assign the appropriate *Yield Curve* to each. Repeat the values used in the **Partial Cut** Stand Group for the *Treatment Values*. In the *GoTo SGrp* tab of the **Partial Cut** stand group, select <**Partial Cut2**>. In the *Age Windows* for Partial Cut2, Partial Cut3 and Partial Cut4, set the *Minimum* age to **210** years to ensure the desired 80% retention is maintained. For *Stand Group* **Partial Cut2** the *GoTo* window should be set to **Partial Cut3**. For *Stand Group* **Partial Cut3** the *GoTo* window should be set to **Partial Cut4** and for *Stand Group* **Partial Cut4** the *GoTo* window should be set to **<myself>**.

Run the Simulation

2.1. Use your **Partial Cut** *Ruleset* to generate a harvest schedule. You should extend the harvest flows to year 340 to allow the model to cycle through all of the partial cutting stands groups. You will notice that the harvest flows have to be reduced in the long term to be sustainable. You should observe the stand groups and ages in the Viewer to confirm that the model is working correctly. With a bit of tinkering on your flows, you should get a smooth harvest schedule similar to that shown below.



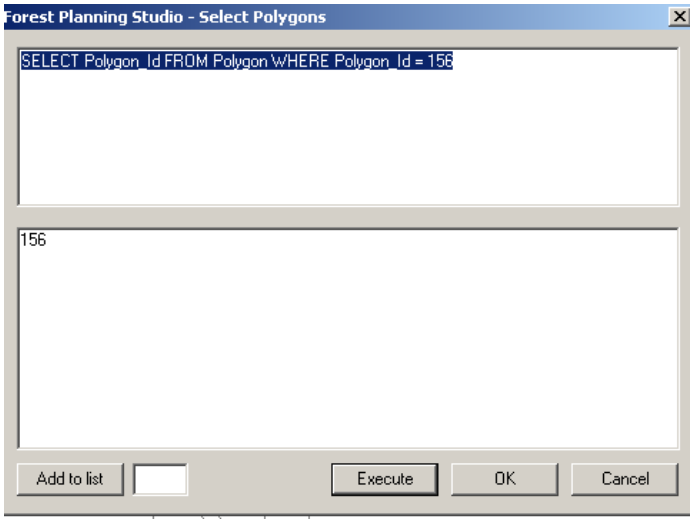
Tutorial 10. Edit Individual Polygons

1. Query the Database

1.1. In the *Viewer Control* select *Polygon topology view*, then select *Stand Group* and expand the *Stand Group* legend.

1.2. Locate the pointer on the *Map Viewer* and right click. A drop down menu will appear, then select *Execute SQL*.

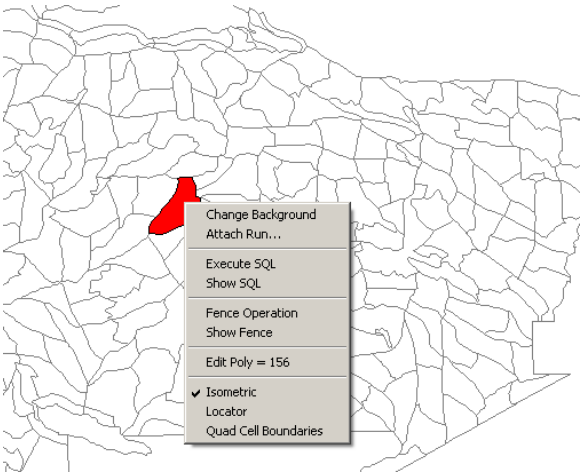
1.3. The *Forest Planning Studio – Select Polygons* window should appear. To find polygon number **156** enter the number after the equal sign. Select *Execute*. **Polygon 156** should appear in the lower box of the window.



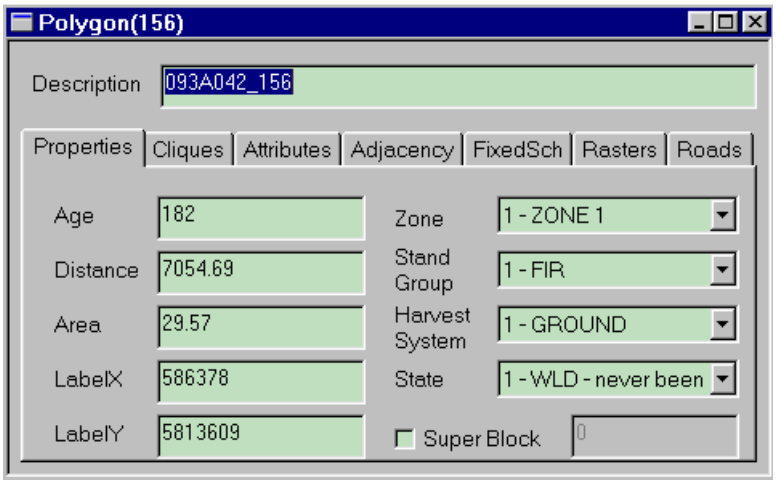
1.4. Select *OK* to view, on the *Map Viewer*, **Polygon 156** should be highlighted on the *Map Viewer*.

Edit Polygon

2.1. Locate the pointer on Polygon 156 and with the right button on the mouse single click. From the drop down menu select *Edit Poly = 156*.



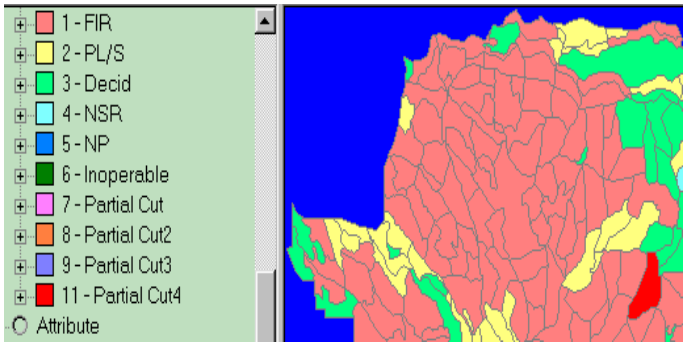
4.2. Select the *Properties* tab with the left mouse button. *Polygon (156)* window should appear. Notice that the *Stand Group* displayed is **1- FIR**. Explore the other tabs.



4.3. **Polygon 156** is classified as *Stand Group 1 – FIR* in this database.

4.4. To edit the *Stand Group* open the drop-down menu, a complete list of *Stand Groups* should appear. Select **Partial Cut4** and close the **Polygon (156)** window to accept the changes.

4.5. To confirm these changes were made repeat steps 2.1 and 2.2 to view the *Stand Group*. To observe the change on the *Map Viewer* it is often necessary to close the existing view and open another view.

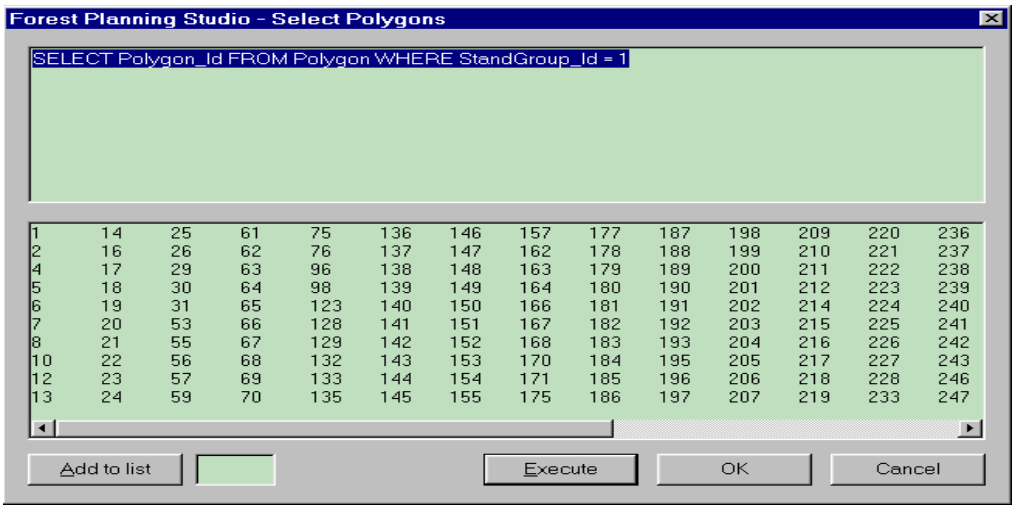


Tutorial 11 Edit by Fencing Polygons

1. Query the Database

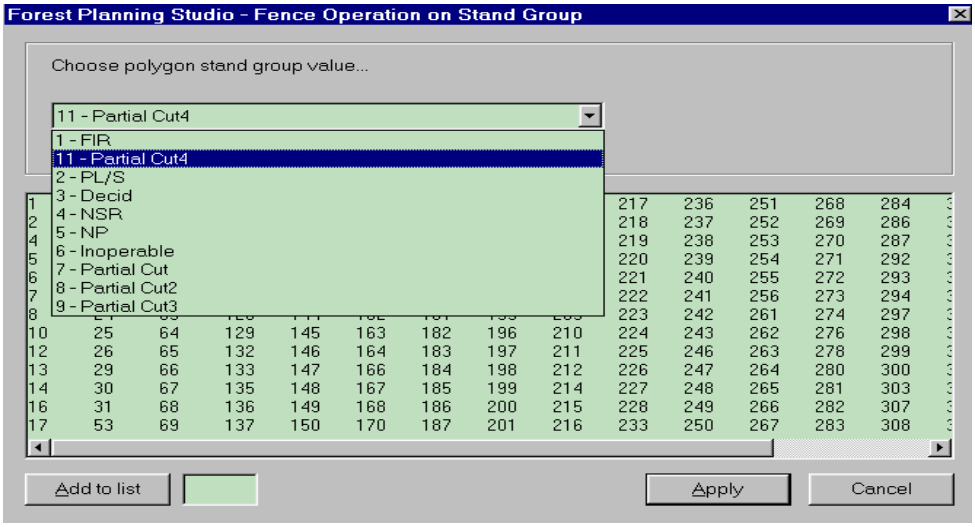
1.1. In the Viewer control, select Stand Groups. In the *Viewer* right click for the drop-down menu and select *Execute SQL*.

1.2. To find all polygons within *Stand Group 1 – FIR* type the command exactly as shown below. Select *Execute*. All polygons within the Stand Group 1 should be listed as shown below. Select *OK* to view the query.



Fence the queried polygons

2.1. From the *Map Viewer* drop-down menu select *Fence Operation*. The queried polygons should be listed in the *Fence Operation* window. From drop-down menu select **Partial Cut4**. Select *Apply* and *Yes* to *Execute* the update. Those polygons have now been edited into the **Partial Cut4** Stand Group. Refresh the *Map Viewer* to confirm that these changes were made.



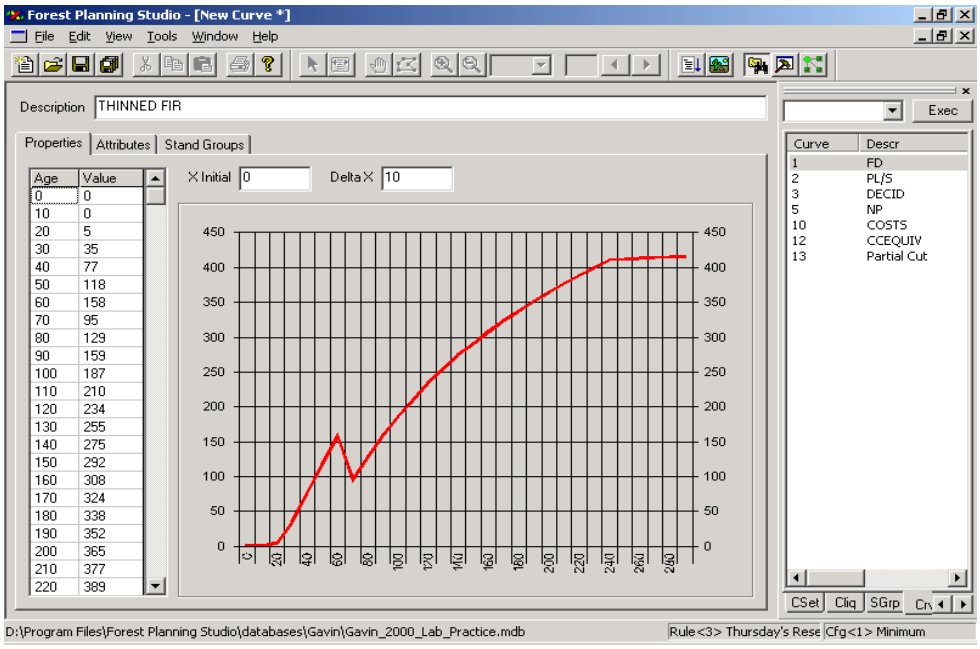
2.2. Now we will return the Partial Cut4 polygons to Stand Group 1 – FIR. To do this, just repeat the above steps but first select all the Partial Cut4 stand groups (# 10 or 11, depending on your database) and change them back to Stand Group 1- FIR. Refresh the *Map Viewer* to confirm that these changes were made (the changes are necessary for the next tutorial).

Tutorial 12 Apply Commercial Thinning

The objective of this tutorial is to learn how FPS models commercial thinning. A query will be used to identify *FIR* stands eligible for commercial thinning. These stands will be commercially *Thinned* (51% volume removal) at 70 years, with a final *Clearcut* harvest at 150 years. To do this, two new *Stand Groups* and a new Age-Volume *Curve* will be created and then selected *FIR* stands will be assigned to these new *Stand Groups*. Continue using the **GavinTut_2.mdb** database.

1. Create a Volume-Age Curve for *THINNED FIR* Stands

1.1. At age 70, remove 51% of the volume ($100m^3/ha/195m^3/ha$ = approximately 51%). Now the **THINNED FIR** curve is similar to the original **FD** stand, except the volumes are reduced by 100m3/ha, as shown below. Save and close the new **THINNED FIR** *Curve*.



2. Create two new *Stand Groups*

2.3. Create a *Stand Group* named **THINNED FIR** and a *Stand Group* named **YOUNG FIR**.

2.4. Open the **YOUNG FIR** *Stand Group*.

2.4.2. In the Age window, select *Thinning* and assign a *Minimum* of **70** and a *Maximum* of **100.**

2.4.3. In the *GoTo SGrp* tab, select *Thinning* and **THINNED FIR**.

2.4.4. In the Treatment Values tab, select *Thinning* and enter **51**%.

2.4.5. In the Curves tab select *Age* and the **FD** curve.

2.4.6. Save and close the **YOUNG FIR** *Stand Group*.

2.5. Open the **THINNED FIR** *Stand Group*.

2.5.2. In the *Age* window, select *Clearcut* and assign a *Minimum* of **150** and a *Maximum* of **999.**

2.5.3. In the *GoTo SGrp* tab select **YOUNG FIR**.

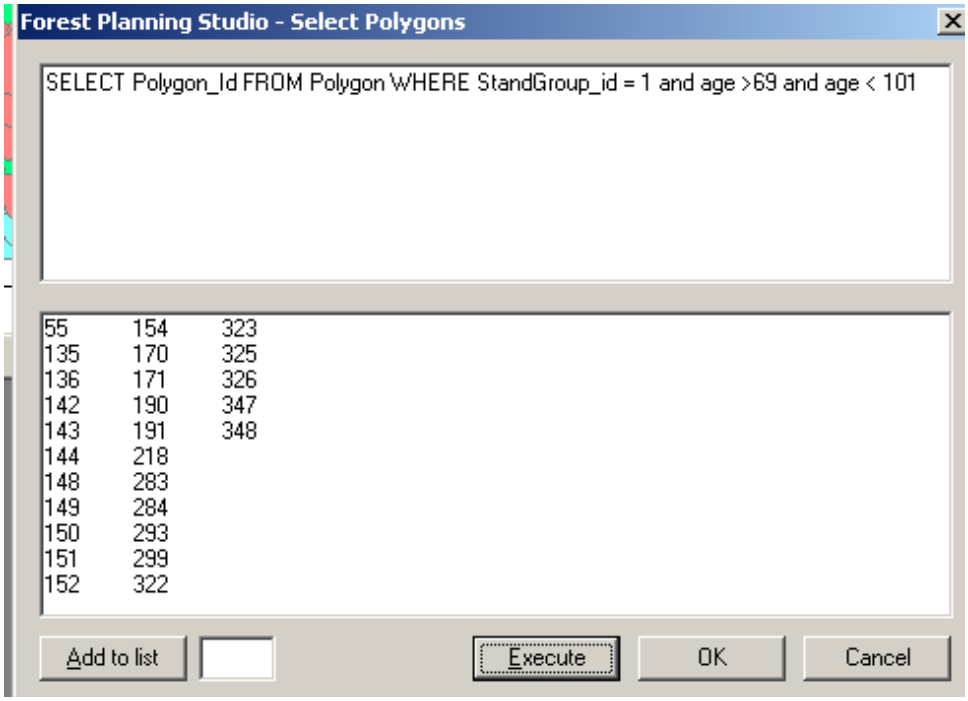
2.5.4. In the *Curves* tab, within the *Age* box, select the newly created **THINNED FIR** curve.

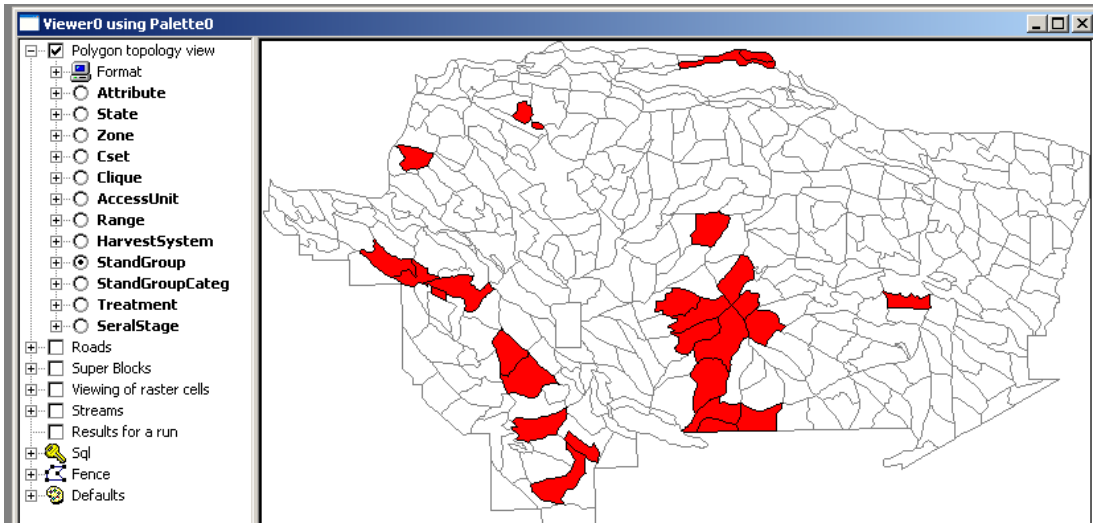
2.5.5. Save and close the **THINNED FIR** *Stand Group*.

Identify Stands Eligible for Commercial Thinning

2.1. Open the ***Map Viewer*** and select the *Stand Group* from the *Viewer Control*.

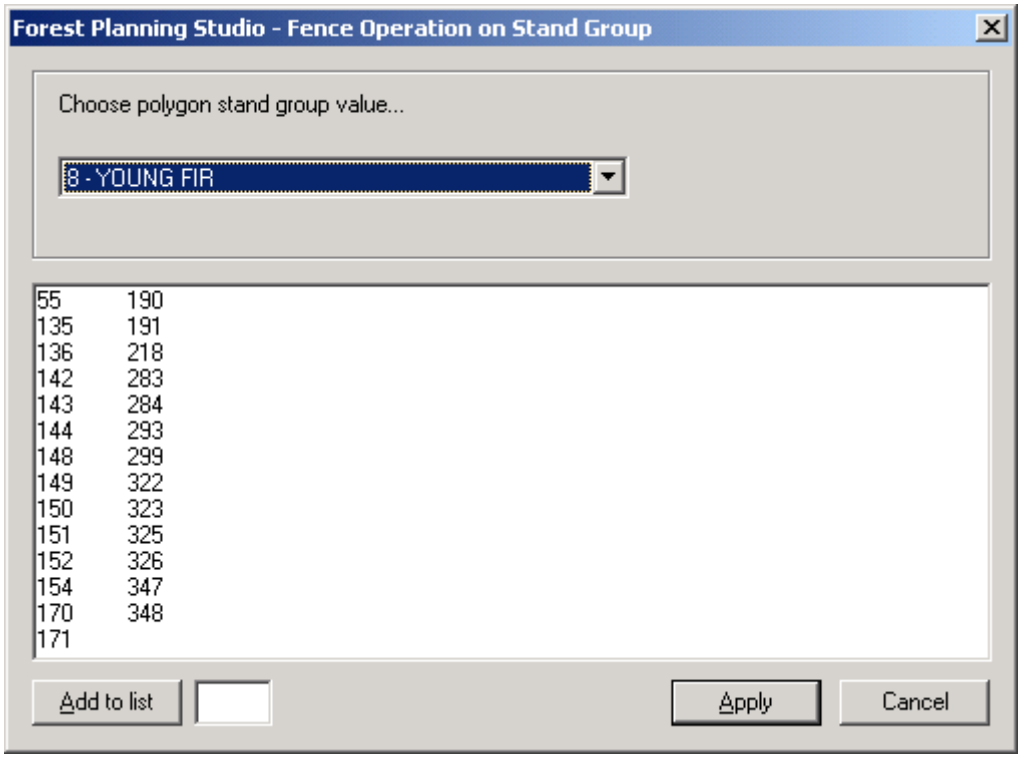
2.1.1. Right mouse click within the *Map Viewer* to open the drop-down menu. Select *Execute SQL*. Modify the syntax to match that shown below. Select *Execute* and *OK*, eligible stands should be highlighted, as shown below. This selects all polygons assigned to the FIR Stand Group (# 1) that are between 70 and 100 years old.





2.2. Right mouse click in the *Map Viewer* and from the drop down menu select *Fence Operation*.

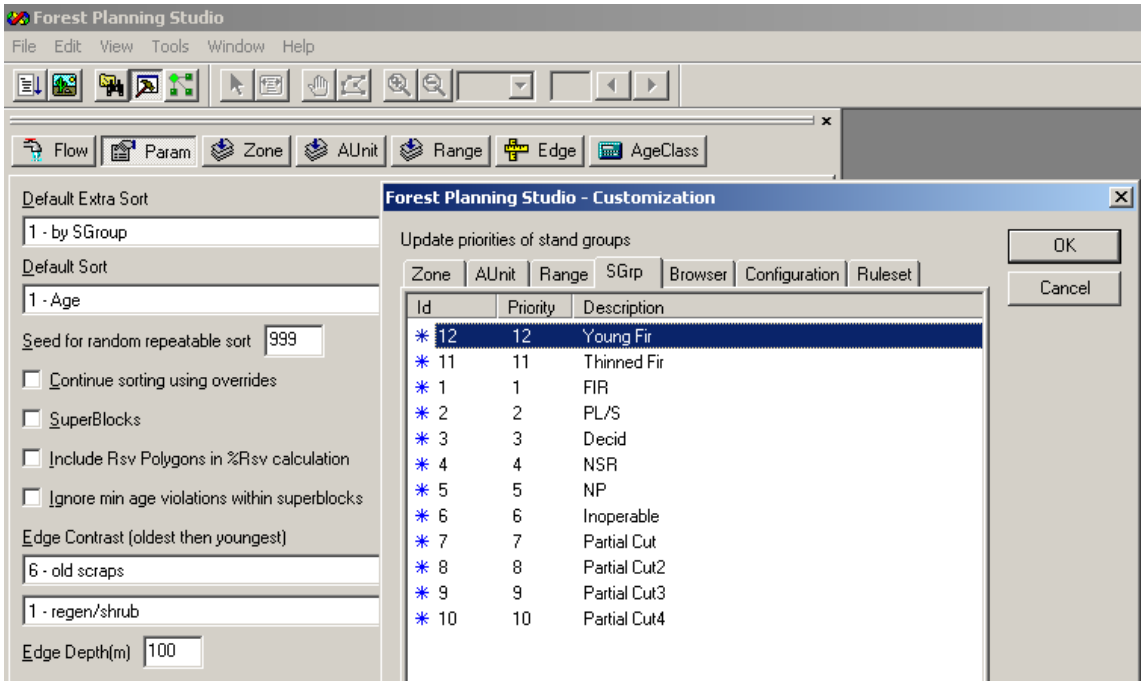
2.2.2. From the *Choose polygon stand group value* drop down menu select **YOUNG FIR** (as shown below). Select *Apply*, and accept the changes. The new stand groups and curve as shown in the Figures below.



Check in the viewer that these changes have been made.

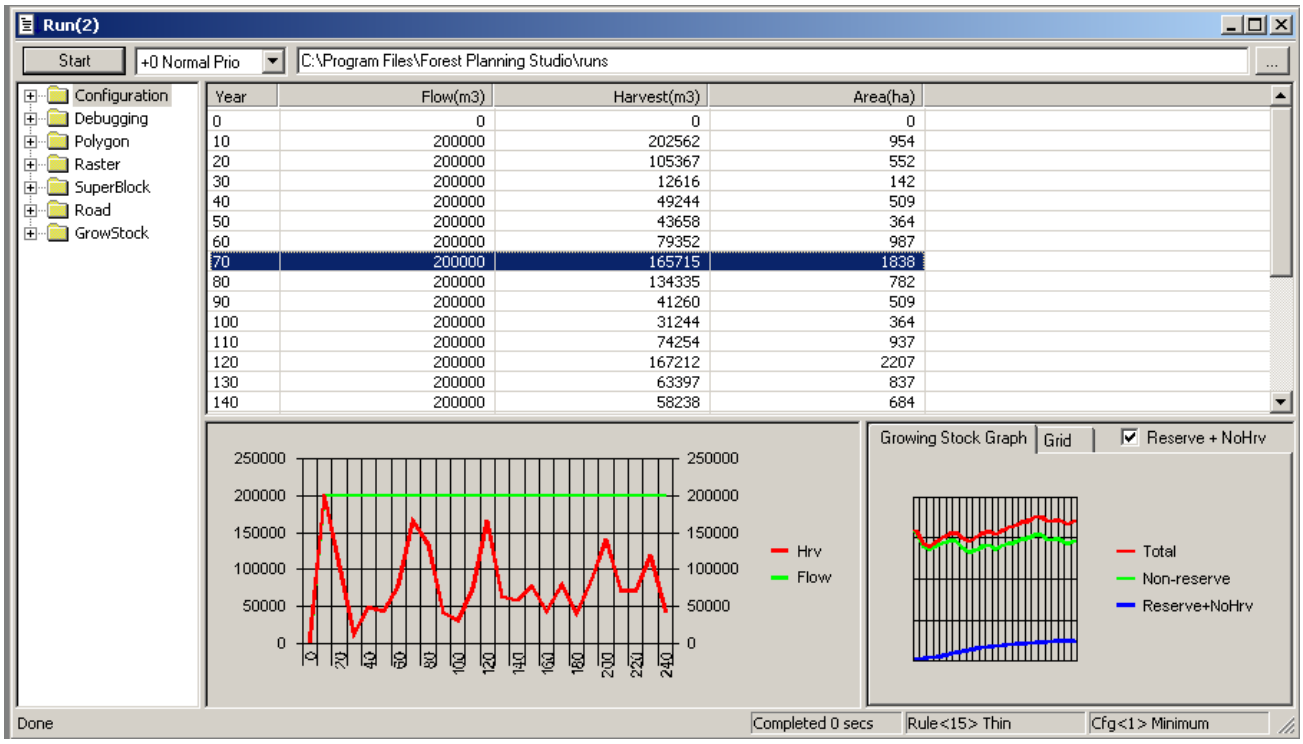
2.3. Create a new *Rule Set* named **Thin.** Set the *Default Sort* = ***Age*** and the *Default Extra Sort* = ***by SGroup***.

2.4. Under *Tools/User Customization*, select the SGrp tab and move these two *Stand Groups* to the top of the priority list to ensure they will be **Thinned** at **70 years** and **Clearcut** at **150 years**. Without these additional sorts, these polygons may not be thinned at 70 years. For example, they may be thinned at 110 years, in which case the 51% removal no longer corresponds to the newly created yield curve.



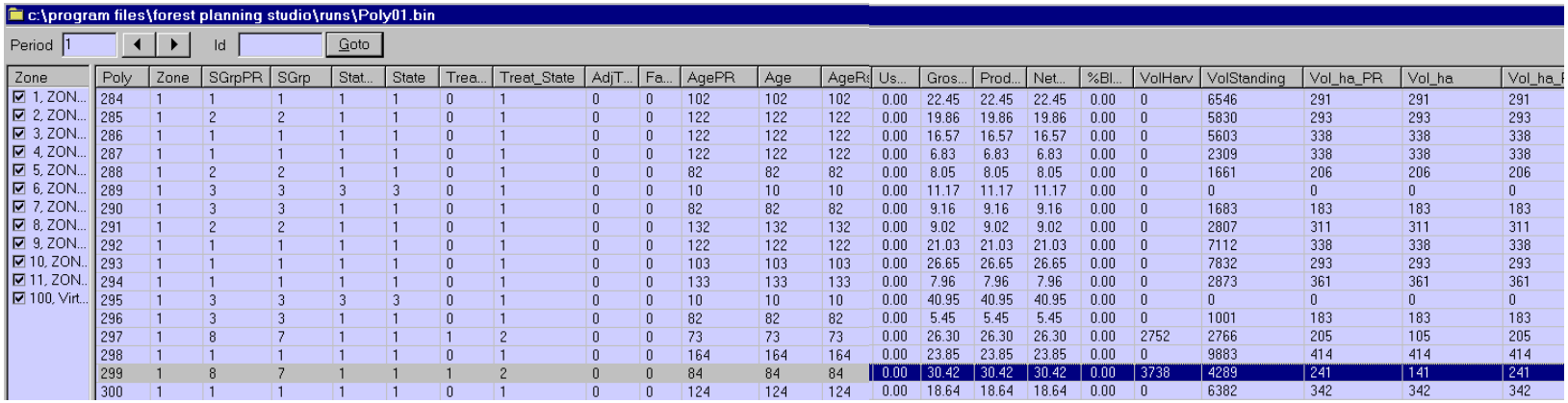
2.5. In the **Thin** *RuleSet*, Set the harvest *Flows* to 200,000 m3/decade for years 10-240. Ensure that there are no *CSets* applied to any zones, cliques, access units or ranges.

Run the model and you should get results similar to those in the following Figure.



Run the model and check that the polygons are being *Thinned* and *Clearcut* at the prescribed times. To confirm that the model is working correctly, select *Stand Group* in the Viewer Control and cycle through the periods. You should see that **Young Fir** is converted to **Thinned Fir** which is subsequently converted back to **Young Fir**. Now select *Attribute – Output Only – Treat_State*. As you cycle through the periods you can observe which polygons are thinned, clear cut, partially cut and those that continue to grow undisturbed. Finally, select *Attribute - Age* in the Viewer Control, and expand the *Format* tree (near the top of the Viewer Control) and check the *Text* box. As you cycle through the periods you will see that three is no change in age when the **Young Fir** stands are thinned, but when the **Thinned Fir** stands reach 150 years they are clearcut and the age is reset to 0.

2.5.2. You can examine the harvest details of Polygon 299 by double clicking on any period in the run window and selecting the polygon option as shown below.



c:\program files\forest planning studio\runs\Poly01.bin

Period 1 Id Goto

Zone	Poly	Zone	SGrpPR	SGrp	Stat...	State	Trea...	Treat_State	AdjT...	Fa...	AgePR	Age	AgeRs	Us...	Gros...	Prod...	Net...	%Bl...	VolHarv	VolStanding	Vol_ha_PR	Vol_ha	Vol_ha_
1, ZON...	284	1	1	1	1	1	0	1	0	0	102	102	102	0.00	22.45	22.45	22.45	0.00	0	6546	291	291	291
2, ZON...	285	1	2	2	1	1	0	1	0	0	122	122	122	0.00	19.86	19.86	19.86	0.00	0	5830	293	293	293
3, ZON...	286	1	1	1	1	1	0	1	0	0	122	122	122	0.00	16.57	16.57	16.57	0.00	0	5603	338	338	338
4, ZON...	287	1	1	1	1	1	0	1	0	0	122	122	122	0.00	6.83	6.83	6.83	0.00	0	2309	338	338	338
5, ZON...	288	1	2	2	1	1	0	1	0	0	82	82	82	0.00	8.05	8.05	8.05	0.00	0	1661	206	206	206
6, ZON...	289	1	3	3	3	3	0	1	0	0	10	10	10	0.00	11.17	11.17	11.17	0.00	0	0	0	0	0
7, ZON...	290	1	3	3	1	1	0	1	0	0	82	82	82	0.00	9.16	9.16	9.16	0.00	0	1683	183	183	183
8, ZON...	291	1	2	2	1	1	0	1	0	0	132	132	132	0.00	9.02	9.02	9.02	0.00	0	2807	311	311	311
9, ZON...	292	1	1	1	1	1	0	1	0	0	122	122	122	0.00	21.03	21.03	21.03	0.00	0	7112	338	338	338
10, ZON...	293	1	1	1	1	1	0	1	0	0	103	103	103	0.00	26.65	26.65	26.65	0.00	0	7832	293	293	293
11, ZON...	294	1	1	1	1	1	0	1	0	0	133	133	133	0.00	7.96	7.96	7.96	0.00	0	2873	361	361	361
100, Virt...	295	1	3	3	3	3	0	1	0	0	10	10	10	0.00	40.95	40.95	40.95	0.00	0	0	0	0	0
	296	1	3	3	1	1	0	1	0	0	82	82	82	0.00	5.45	5.45	5.45	0.00	0	1001	183	183	183
	297	1	8	7	1	1	1	2	0	0	73	73	73	0.00	26.30	26.30	26.30	0.00	2752	2766	205	105	205
	298	1	1	1	1	1	0	1	0	0	164	164	164	0.00	23.85	23.85	23.85	0.00	0	9883	414	414	414
	299	1	8	7	1	1	1	2	0	0	84	84	84	0.00	30.42	30.42	30.42	0.00	3738	4289	241	141	241
	300	1	1	1	1	1	0	1	0	0	124	124	124	0.00	18.64	18.64	18.64	0.00	0	6382	342	342	342

Note that in Period 1 **Polygon 299** is *Thinned* at 84 years. Prior to being cut, the volume (**Vol_ha_PR**) was **241 m3/ha** , after thinning the volume should be **141 m3/ha** (**Vol_ha**). These volumes are derived by interpolating the yield curves at 84 years of age. **It is important to note that the age of the polygon does not change when thinned.** Select Period 8 and notice after being Clearcut, **Polygon 299** is returned to the Young Fir *Stand Group*.

Try smoothing out the harvest flows. Left as a student exercise.

Frequently Asked Questions

- How do I make a new record (clique, zone, etc.)? – see file menu – new.
- How do I delete a record (clique, zone, etc.)? First make sure it is empty, then right click and select delete.
- How do I add a constraint set? – ctrl <down>, then double click to get list box.
- How do I add a flow in the *Rule Set*? – ctrl <down>. Also use right click to configure flows and/or copy flows o another *Rule Set*.
- How do I move a zone to another new access unit, or access unit to another range? – use the zone or access unit forms.
- Viewer colours are wrong – you probably have the display order wrong. See tools – palette customization to change order of layers.
- Viewer doesn't update surface types, SGC, etc. First try F5 to refresh the screen. If no success, you probably are dealing with a "persistent" variable that is only loaded when the program starts. Try closing and re-starting FPS-ATLAS.
- Windows (forms) don't update after I change them. Either hit F5 or tab off and on to refresh them. You can also use the Exec button on the browser.
- Run time is slow – turn off optional reports.
- Edge definition is incomplete – either you haven't defined edge, or it is not defined for this *Rule Set*. See *Rule Set* parameters or Edge Definition Table in the database.
- *Rule Set* parameters complain about edge and seral stages – means you haven't defined seral stages and/or edge. Add these through the browser and re-start.
- I keep getting new directories every time I run it – set a default directory in the run window.
- I'm frustrated with this model. Try these: 1) go have coffee, rest and try again, 2) read the manual, 3) call an analyst, and 4) pay big bucks for another model (and analyst).